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Buyers' Guide

EDITION

AVIATION WEEK

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AIRCRAFT

MISSILES

AVIONICS

SUPPORTING
EQUIPMENT

NUCLEAR
SYSTEMS

AIRLINE
& AIRPORT
EQUIPMENT



Engineer Holds Buying and Selling Key

The 1955-56 Aviation Week Buyers' Guide is geared to keep pace with the revolutionary changes forced upon the aircraft industry by the introduction of the weapon system.

The key man in the buying and selling of weapons now is the engineer. To his major function as researcher, developer or designer, he has added two roles of equal importance: he is his own salesman and his own purchasing agent.

At the same time, the traditional tasks of salesman and buyers have been extended to include new supporting functions in advising and aiding engineers in the many nuances of contract negotiations, prices and schedules.

Working together within the organizational framework of the weapon system, the sales, buying and design teams have achieved a technical unity that was impossible under the original scheme of separate departments.

This first Aviation Week Buyers' Guide was planned to help these teams in their major task of strengthening the air power of the free world during the age of peril.

Two major factors have placed responsibility for weapon system procurement squarely in the lap of the engineers:

- Technical complexity of new systems demands that they be sold by engineers to engineers. They have specialized knowledge necessary to buy or sell a computer-controlled system, a rocket motor injection head, or a magnetic amplifier.

- Time can be saved and the possibility of misunderstanding avoided by the engineering purchase or sale of engineered systems, rather than by following the old routes with salesman or purchasing agents as middlemen.

But while the engineer has the design know-how, he doesn't know where to go or whom to see; the opposite is true for the salesman or the buyer.

In extreme cases, these people don't even know—let alone understand—each other's problems.

For those reasons, this Buyers' Guide is di-

vided into three major groups of material: the first is a series of articles on the techniques of doing business with the military services and the airlines; the second is a detailed listing of the people who do the buying for the military services and the airlines; the third is a comprehensive listing of the myriad of manufactured items that make up the shiny intercepter, the colorful airliner and the black-and-white missile.

SECTIONS OF GUIDE

One of the many new features of the *Aviation Week Buyers' Guide* is the division of manufactured products listing into six separate sections:

Thus has been done for maximum convenience in finding any particular item. The six sections include:

- **Section A: Aircraft.** The products that are installed either complete or as major systems in an airplane are listed within this section. Powerplants, major components, such complete units as seats or control assemblies are to be found in Section A. But the section does not include fasteners, hardware, raw materials and other items that are common to airplanes, missiles, vehicles and avionics equipments; they are listed separately.

- **Section B: Missiles.** During the past decade, the guided missile has grown from an engineering toy to an operational field weapon system, and as such, is treated separately in a section of its own. Listings are similar to those in Section A, but are applicable specifically to missiles. Specialized supporting equipment, such as missile launchers, are also listed, but common support items are not included here.

- **Section C: Avionics.** The 100-fold growth of this new industry over the past fifteen years is reflected in the galaxy of specialized equipment listings in this section. The items include all the common parts—tubes, transistors, switches and rheostats—that are the building blocks of the complex equipments. Listed also are the large radars and computers, fire-control systems and

specialized units that supplement and extend man's knowledge and control of a weapon.

- **Section D: Supporting Equipment.** In the development of a weapon system, one of the first things the manufacturer realizes is that he has to build or buy a lot more than an airplane or a missile. He may have to supply automotive equipment or special trailers or teach a seminar course. The increasing importance of the task of support of a weapon system is recognized by setting these items apart in a category of their own. These are the "shoes and signs and sealings"—items, from office furniture to explosive rivets, from machine tools to paint and lacquer. This section includes all the hardware items, fasteners, raw materials and services that go into supporting functions.

- **Section E: Nuclear Systems.** The aircraft industry is deeply involved with the atom and the energy in its nucleus. With almost every major aircraft company conducting studies of nuclear power, the next few years should see the completion of at least one nuclear engine for aircraft propulsion. This section lists not only certain tangible items related to nuclear systems, but also—in recognition of one of the major problems facing the industry—the academic and Government centers of training and education in this newest science.

- **Section F: Airline and Airport Equipment.** The burgeoning business of air transportation has far outstripped almost every prediction ever made for its growth. In this section are listed the hundreds of companies, small and large, that sell transportation of people or cargo, the manufacturers of large fixed items like ladders and runways and lighting systems, and the services of airport construction.

ENDING DEVELOPMENT

The major aim of efficient buying is the same as that of efficient engineering: to reduce the development time lag between the prototype and production items. During the past few months, these changes have been made by the military in an attempt to cut months off the development cycle.

- Purchasing operations have been streamlined. Both the Air Force and the Navy have reorganized and redirected their purchasing efforts to eliminate unnecessary bills, and to make it easier

HOW TO USE THE GUIDE

If you are designing . . .

You will find the names of prospective manufacturers and suppliers of the items you may require in six sections of product listings.

If you are selling . . .

You will find the names of the buyers of complete systems and components for the military services and the commercial airlines listed between pages 15 and 26. You will find manufacturers listed in its separate product sections.

If you are buying . . .

You will find many new names of prospective suppliers and subcontractors among the six product listing sections.

Advertisers in the 1955-56 *Aviation Week Buyers' Guide* are listed in bold face capital letters.

for a prospective supplier to do business with them.

- Requirements are being shared with industry. In tackling the knotty problem of how best to buy research and development, USAF's Air Research and Development Command has set in motion a new plan for sharing its thoughts on future weapons needs with industry. In effect, ARDC is trading its long-secret studies of future requirements for time saved in the development cycle.

On the side of industry, some companies have developed special techniques for aiding their prospective subcontractors and suppliers. Among these is Boeing, whose program for subcontractors is described just at the start of Section A.

Airline buying follows a different pattern for each different operator. The procedures of four of the major carriers serving this country are detailed as an introduction to Section F.

The aircraft industry represents a \$10-billion annual market for the next two or three years. It offers a prospective sale for almost every imaginable manufactured item or proffered service.

This *Aviation Week Buyers' Guide* is the first new approach to understanding and reaching that market.

Sales Near \$10 Billion Mark for 1956

By Robert Hunt

The aircraft industry will continue close to its post-war peak levels during 1956. Outlook is for a stable military production of airframes, gas turbine engines, missiles and atomic gear at about the 1955 level with an increase in commercial production of transport aircraft for the airlines and executive type planes for the growing business flying market.

Profits for 1955 will remain close to the 1954 level for the industry as a whole but with larger discrepancies between the net incomes of individual firms as results of the new military policy of selective buying become more pronounced. The profit picture for these firms will be clouded by effects of the Renegotiation Act. The Renegotiation Board has nearly completed its redeterminations of 1952 profits in the aircraft industry and will soon start checking the increased profits of 1953.

The industry will place heavy emphasis on research and development activity as the pressures in military business for technological breakthroughs on new aerial weapons systems become greater. Much of the industry's capital expenditures will be for new development facilities including supersonic wind tunnels, gas turbine engine laboratories, and missile test facilities.

Military customers—the Air Force, Navy and Army—will continue to take the largest slice of the aircraft industry output during 1956. The three services have about \$25 billion available in funds, appropriated by Congress but not yet expended, for aerial weapons system hardware and support.

Military sales will continue at about the 8.5 billion level of the 1954-55 period during 1956 while commercial business including both the airline and executive plane market will run close to the billion dollar mark.

Three factors are the principal influences in the aircraft industry:

1. The rapid progress being made by the Russians in development of modern aerial weapons and atomic armament. There is no argument now in Pentagon, White House or Congress that the Russian rate of progress during the past three years in these fields has outstripped all our estimates. Now in these much argument against accelerating the pace of our development effort and enlarging the scope of aeronautical research.

In addition, production of our most advanced weapons such as the supersonic Lockheed F-104 fighter, the McDonnell F-101 long-range interceptor and the Boeing B-52 strategic bomber will be accelerated during 1956.

2. The rapidly increasing pace of aviation technology. Trevor Gardner, Assistant Secretary of the Air Force for Research and Development, recently said:

"We are trying to make more technical progress in aviation during the next five years than we have in the whole previous fifty years of powered flight."

This rapid technological progress induces a swift rate of obsolescence among aerial weapons systems and requires a quick replacement factor.

ARMED EQUIPMENT

3. The necessity of the world airlines to re-equip their fleets with gas turbine powered transports. During the last quarter of 1955 nearly \$1 billion in orders for turboprop and turboprop transports were placed with U. S. manufacturers alone. Equipment purchases by airlines will reach an all-time peak during the next five years as airline passenger and cargo volume soar to new levels, stimulated by the high efficiency, low cost operation possible with gas turbine powered transports.

Plant expansion will continue at a modest level confined principally to new guided missile facilities located in the Midwest and Southwest and the previously mentioned research and development facilities.

The military aviation market for the next five

years will be dominated by four major new tasks confronting the Air Force.

These tasks are:

- Air defense system. The problem of building an adequate air defense system for the North American continent against attack by supersonic aircraft and guided missiles poses tremendous technical, production and logistics problems. Little more than a beginning has been made on this job.

- Air logistics system. The supersonic pace of modern air war cannot be tied to the mail's pace of surface transport. Air Force has already begun establishment of an air logistics system that now moves all high cost items such as jet engines and avionics gear from factories and depots directly to operating units. This means development of new type jet transports and widespread application of electronic computers to eliminate hand work.

- Nuclear power. Development of nuclear powered aircraft is a top priority military program embracing almost all engine manufacturers and large airplane builders. It will require special technical skills of an entirely new variety.

- Intercontinental ballistic missiles and space satellites. Two major programs are already under way to produce missiles reaching top speeds of Mach 20 with a range of 5,000 miles. A program to produce the first space satellites for launching in 1957 has also been organized.

MILITARY GROWTH

The guided missile business will grow during 1956 to the \$1 billion level for the first time as one generation of missiles goes into large scale production and operational use while a second generation of more complex missiles emerges into the advanced development stage. Defensive missiles such as the Douglas Nike, General Electric and Bendix Talos are in the production stage. Submarine offensive missiles such as the Douglas Hovey John, Finmeccanica Corporal, Vought Regulus and Martin Matador are also in operational use. For offensive aerial armament the Hughes Falcon and Sperry Sparrow are in production.

Next generation of missiles include more sophisticated concepts such as the Boeing Bomarc defensive missile system; the Fairchild Petrel, anti-submarine missile; the Northrop Quack and North American Navaho, both intercontinental cruise type missiles; and finally the long-range General and Martin ballistic missiles.

The market for commercial aircraft will boom during the next five years due to increasing demand for airline transports and executive type business planes. The total market for gas turbine powered airplanes is estimated at about \$9 billion but with the new route expansion and competitive encouragement policy of the Civil Aeronautics Board air traffic and equipment demands may exceed current forecasts. Business flying is a steadily growing market not only for new aircraft in the \$800,000 price range on down to \$15,000 four-place planes but also for avionics equipment, maintenance and special equipment. Business flying now pays an annual maintenance and operations bill of about \$500 million.

AVIATION AIRWAYS

Development of the military air defense system and air logistics system combined with the heavy growth of airline and business traffic volume is driving development of a new federal electronic airways system to handle this rapidly increasing number of planes using the North American air space in all kinds of weather. Present programs call for expenditures of about \$500 million on electronic ground equipment for this system during the next five years with a corresponding amount required for purchase of airborne equipment by commercial users of the airways system.

The helicopter market will grow slowly with the bulk of sales still being military. Major growth in the transport helicopter field of commuter and interurban service is still awaiting the appearance of the 35-40 passenger twin engine type helicopter.

AIRPORT CONSTRUCTION

Development of a new system of military and civil airports throughout the world to accommodate jet aircraft and the high traffic volume already in sight will mean continued high-level activity in this field. Military airport construction will continue close to the \$1 billion annual level of the past year and civil airport building will run close to \$150 million annually for the next few years with an increasing tempo of construction likely by 1958.

During the next two years aviation will register its largest growth in the commercial fields while maintaining the solid backlog of military business that has expanded its production capacity to the largest in history.

USAF Buying \$10 Billion in 18 Months

By Claude White

The United States Air Force is the world's biggest business, which means it is the world's biggest single market.

• It has assets of \$70 billion, or \$12 billion more than the combined assets of the 24 largest corporations in America.

• It has more than a million separate items each year. For these items, it spends more money than is laid out for all kinds of material and merchandise for the combined purchases of U. S. Steel, duPont, Standard Oil of New Jersey, American Telephone & Telegraph and General Motors.

• It will take delivery on \$10 billion of supplies and equipment during the next 18 months.

Pushing agent for most of this material is the Air Materiel Command, with headquarters at Wright-Patterson Air Force Base, near Dayton, Ohio. AMC controls nearly 45 per cent of USAF's assets, or about \$30 billion. This is \$6 billion more than the combined assets of the Metropolitan Life Insurance Co. and the Bell Telephone System.

One of the first things a businessman must learn about the Air Force and AMC, its major purchasing organization, is that they are the Pentagon in Washington and Wright-Patterson. They are both extremely well organized.

AMC is decentralized. This is done both for the convenience of the businessmen and the efficient operation of AMC's procurement activities.

There are 18 Air Procurement Districts (APD) scattered over the United States from Alaska to San Diego and Milwaukee to Albany. Almost without exception, these offices are in downtown locations. They provide the contractor's main contact with the Air Force from the time he is making the possibility of making a sale to AMC until the after he is administering the contract.

At the beginning of the cycle, the APD is prepared to give potential contractors all the necessary forms and instructions needed to make a proposal or submit a bid. The offer is studied to help the businessman solve ideas, to clarify and understand problems. It has available information on quality control, business plant security as well as all the other past activities that flow from the first time when a manufacturer starts selling to the Air Force.

Each APD office has a bid board displaying report of pending proposals. This enables both formally authorized personnel, to be brought from the most economical and reliable sources, and those registered manufacturers who are not available for word to small business owners.

When only two companies, second awarded of USAF contracts is done, the contract is given to the Air Materiel Command, where Air Force Districts and Headquarters, AMC. Both products

and locations are taken in determining where a contract is awarded.

A lot of these offices is on page 15 along with the announcements on which they have responsibility.

AMC questions the plan that the prospective bidder should master his APD, not the AMC or depot. It is both possible and likely that a contractor will be asked to visit an AMC or depot in the course of his negotiations, but he should not do this until requested. Over the contract is awarded, it is administered through the APD office.

Sources Listed

When an APD issues a new tender in its district is interested in making an AMC contract, the first step is to place the firm, if eligible, on the Procurement Source List. This means the obvious double-hatched purpose of giving AMC

a list of potential suppliers and ensuring that the contractors will be notified when an opportunity appears.

The potential supplier can get on the Source List by giving a personal visit to his nearest APD office. An equally efficient method is to write a letter to the commanding officer of the APD. The request should be accompanied by pertinent information about the business, such as details of present activities, members of companies and products sold or manufactured.

In response to this, the company will be sent a Bidder's Marking List Application, Air Force Source Lists and company information. The information will explain how to select and mark the code numbers of products the firm can supply. The completed application and marked source lists must be returned to the APD office.

As a result the company and its status will appear as bids in the code and be exchanged information. The cards will be on file at AMC headquarters and the appropriate field buying institutions for the products available from the plant.

While USAF personnel visit to Air Materiel Command and depots at this stage, it does not discourage visits to APD offices. It encourages them. There are many advantages to discussing business problems and getting direct information from AMC experts located in APD offices.

One of the things that will be brought to a potential supplier's attention at this point is that separate contracts are made for each individual buying agency. There is one for the items bought at AMC headquarters and one for each of the AMC's depots.

All commodity lists must be secured for sales possibilities. The lists are, of course, available at the APD office.

Bids and Proposals

At this point, two major forms demand full attention from the would-be contractor: IFR and RFP. They stand for Invitation for Bid and Request for Proposal.

Invitations for Bid (IFB) are issued to firms on the Source List by the purchasing agency—AMC headquarters, the AMC or depot. They go out to all companies that expressed an interest in something a particular item is purchased through formal advertising. The IFB can be obtained upon request and a fee is not on the Source List.

Requests for Proposal (RFP) are issued to firms already established within the system who are known to be capable of producing a certain item. This is a preliminary to negotiated procurement.

Normally, procurements are awarded whenever and wherever possible. It is not necessary to be on a Source List to know about IFBs and RFPs when they are in circulation.

Part of the reason of the growing emphasis placed on the contribution of small business, the documents are printed in APD offices when the product sought is one suitable for production by a small business plant.

Business Listed

Next of the factor business also is published in trade and daily papers as well as the "Source List of U. S. Government Proposed Procurement and Contract Awards," published in Charge by the Department of Commerce. It is a daily report that can be obtained by subscription.

USAF Purchase Requests, which are the internal documents authorizing AMC to start buying, usually are submitted directly to the buyer of that particular equipment. The buyer then refers to the Source List to find out to find out which firm to contact.

AMC recognizes that every effort is made to get as much with all small business whenever an item comes up for procurement. This is the way in which small contractors who never did any business with USAF, get accustomed to bid or submit a proposal for contracts.

However, the rule was a company can be made of receiving IFBs or RFPs is made more for submission of bids to make sure it is listed in the Source List. For all those it is capable of producing.

Local Purchases

Like the other armed forces and branches of the government, USAF buys a vast amount of housekeeping items identical with goods on the commercial market for civilian use. Many of these come under the category of "Local Purchases" and are put there in part of USAF's effort to have its installations benefit local business without passing.

This buying, usually from outside firms, is done by Headquarters, depot or base purchasing and contracting offices. A typical "Local Purchase" list is on page 20.

A Qualified Product, to the Air Force, is a item that has been tested and found to meet certain specifications as to quality and performance. There is a Qualified Product List of items that have met this test and the names of those firms capable of taking a contract.

USAF requires that an item be qualified prior to procurement when the quality of the following conditions prevail:

• The item is being tested after award will qualify after delivery.

• The cost of repetitive testing is excessive.

• The tests require expensive or complicated testing equipment not reasonably available.

• The interest of the Government requires assurance, prior to award, that the product is satisfactory.

• The determination of acceptability requires performance tests to apply normal technical requirements contained in the specifications.

Under USAF regulations, only companies whose product is on the Qualified Product List are acceptable to replace the certain items.

Each specification for a qualified product sets out the way in which the product will be qualified, where to submit samples, etc. Qualification testing must be conducted at the expense of the manufacturer.

In the case of the Qualified Product, all items listed in the APD office. Each APD has on file the "Index of Specifications and Publications." It includes a current list of the products which USAF feels must be proven before being bought. The list names laboratories whose evaluation test results will be accepted by the Air Materiel Command.

Small Business

Of more importance in USAF procurements is the Small Business Program. Under Congressional intent, a small business is one employing fewer than 500 persons. The Air Force is obligated to see that small firms get a fair share of its contracts.

To effect this, there is a Small Business Specialist and a staff at each APD office (see last on page 19). It is their job to stress direct word to small business owners and potential suppliers.

The first thing of proposed purchases is made by a group of experts who decide whether or not it is suitable for submission by small business. The products are accepted or not be built in large quantities by a firm with fewer than 100 employees. If there are hundreds of items which are suitable, in fact, may be made more than large quantities.

This being, usually from outside firms, is done by Headquarters, depot or base purchasing and contracting offices. A typical "Local Purchase" list is on page 20.

Lists Circulated

The Small Business Specialist at each APD office keeps a list of these firms, it is circulated to all procurement units and depots to insure full recognition of those firms capable of taking a contract.

While the growing emphasis of various efforts tends to reduce the small business potential from AMC, the Air Force tends to benefit these firms has increased their ability to win contracts for the items they are capable of making. These contracts, which probably cost 30 per cent of all items that can be built by virtue of their skill and facilities, as judged by USAF.

In practice, most small business still making up a USAF contract are made in procurement. It is an important factor that most of their manufacturing is accomplished. Hence the APD Small Business Specialist is asked to visit small business opportunities in a private sector of the region. He is prepared to advise and help small business in obtaining requirements from USAF procurement.

Under the Small Business program, price contracts contain a clause requiring the supplier submit manufacturer to affirm the facilities of small business.

Reviews of Specs

A final subject of major interest is the potential for contract in small business. These pages of paper are undergoing continual revision. For this reason, USAF usually does not furnish them until procurement of an item has been initiated.

Specifications normally are mailed out with the IFB or RFP. The APD office maintains a file of these, often printed, and they may be consulted as an interested party. The same printing of specifications and drawings is expensive, USAF discourages wide distribution and requests that copies be made only in the context of actual delivery.



Services List Nine Contract Types Governing Buying of Military Items

One of the major responsibilities of the negotiator is the selection of the type of contract best suited to the procurement which he is conducting. This choice will have its important effect on the ultimate cost of the contract, on the incentive given the contractor to use materials and manpower efficiently, and on the nature of the negotiations which must be conducted over the performance of the contract. While each agreement between the negotiator and the contractor is desirable, the negotiator should not bury the decision on the contract type to be used. This decision will be based on a number of factors: the nature of the procurement, the negotiator's position and his competence, the degree of competitive interest, the availability of competitive cost data, the importance of business risk, and the extent of the control which can and should be maintained over the contractor's operations. It is doubly important to avoid a premature decision, because the cause of the negotiations will be considerably influenced by the type of contract contemplated for use.

Under certain circumstances it may be desirable to obtain greater flexibility in contract negotiations by using the contract to quote prices on more than one type. In such circumstances, if only one type of contract is considered and quoted upon and if, during negotiations, that policy notwithstanding, a new contract proposal unduly delays will be required, and much time and effort will have been wasted.

If it were always possible to establish firm prices which were fair both to the contractor and the purchaser, the determination of the most suitable type of contract would be no problem. A Firm Fixed Price contract would be used for all procurements. But the determination of fair prices for many items purchased is often a difficult, if not impossible, task. For this reason, several major types of contract have been authorized for use by negotiators, as well as a number of specialized types designed to meet specific situations.

1-1 Firm Fixed Price Contracts

- A. Explanation
 - (1) Supplies or services are furnished at a specified firm price regardless of actual cost of performance.
- B. Use
 - (1) When award cost estimates are available.
 - (2) Contracted type items available from competing sources.

- (3) Military type equipment previously produced on which relevant production and cost experience are available.
 - (4) When a contractor desires to share costs of a Research Contract.
- C. Advantages
 - (1) Places maximum risk and responsibility upon the contractor; consequently, results in the greatest incentive for cost reduction.
 - (2) Easiest and least costly type of contract to administer.
 - D. Disadvantages
 - (1) Price may include excessive allowance for contingencies.

1-2 A. Incentive Fixed Price

- A. Explanation
 - (1) Supplies are furnished at a tentative firm price (target price). Upon completion of the work the price is determined based on the contractor's actual costs plus a dollar amount of profit which varies inversely with the cost. The recommended price ceiling exceeds the ceiling price stated in the contract.
- B. Use
 - (1) When production is spread over a relatively long period.
 - (2) When difficulty is encountered in negotiating a firm fixed price earlier for anticipated production conditions.
 - (3) When target costs can be established initially so that an early status point with substantial accuracy.
 - (4) When reasonable opportunities for cost reduction through contractor efficiency exist.
- C. Advantages
 - (1) Not necessary for contractor to include excessive allowances for contingencies.
 - (2) Encourages cost reduction by contractor.
 - (3) Government shares in contractor's cost reductions.
 - (4) Government receives "after-the-fact" cost information in relation to negotiating follow-on procurements.
- D. Disadvantages
 - (1) Bidding the ceiling, the starting price, and the profit sharing formula; contract can be adjusted to fit many situations.
 - (2) Contractor has less incentive than under a firm fixed price contract.
 - (3) More costly and difficult to administer than a firm fixed price contract.

1-2 B. Maximum Price

- A. Explanation
 - (1) Supplies are furnished at a maximum price which is predetermined (only after a specified percentage of the work has been completed). The final price is based on actual costs incurred to point of redemption plus estimated costs to complete.
- B. Use
 - (1) When award cost estimates cannot be made at the beginning of the work, but can be made after a certain percentage of the work has been completed.
 - (2) Repetitive work, in that cost experience on first portion permits accurate prediction of completion costs.
 - (3) Work extended over a relatively long period of time to permit redemption before completion of contract.
- C. Advantages
 - (1) Permits firm price contracting even when award cost estimates are not possible at the beginning of the work.
 - (2) Final price is based on actual cost information.
- D. Disadvantages
 - (1) Up until the time of redemption, contractor has little incentive to keep costs low.
 - (2) Because of time lag between point of redemption and re-determination negotiations, contractor not only has later cost information than negotiator, but may have completed a very large percentage of the work.
 - (3) More costly and difficult to administer than a firm fixed price contract.

1-3 C. Flexible Fixed Price

- A. Explanation
 - (1) Supplies are furnished at a tentative price which is predetermined (subject to a ceiling) or downward after a specified percentage of the work has been completed. The final price is based on actual costs incurred to point of redemption plus stated costs to complete.
- B. Use
 - (1) Applicable to those "after-the-fact" cost information in relation to negotiating follow-on procurements.
- C. Advantages
 - (1) "Contract" since final difference at that price can be predetermined in advance.
- D. Disadvantages
 - (1) Similar to those listed for "Maximum Price" contract.

1-3 D. Fixed Price With Escalation

- A. Explanation
 - (1) Supplies are furnished at a fixed price which is subject to revision on the occurrence of specified contingencies.

and contingencies. Applies to situations in which prices tend to rise and not to the quantity of material or labor required.

- B. Use
 - (1) When increases in demand in specific costs such as material prices or labor rates are beyond the control of the contractor.
- C. Advantages
 - (1) Government avoids paying for contingencies that do not occur.
 - (2) Permits firm price contracting even if contract cost elements are not subject to accurate prediction.
- D. Disadvantages
 - (1) Government assumes part of contractor's risk.
 - (2) Additional administrative problems.

11-1. Cost-Plus-Fixed-Fee

- A. Explanation
 - (1) Supplies or services are furnished at actual cost plus a fixed fee which is based on a negotiated percentage of the original estimated cost.
- B. Use
 - (1) When it is impossible to estimate costs with any degree of accuracy.
 - (2) Research and development work.
 - (3) Specifications not firm.

- C. Advantages
 - (1) Government avoids paying for contingencies that do not occur.
 - (2) Profit not based on costs so contractor has no incentive to pad costs.
- D. Disadvantages
 - (1) Contractors have little incentive to reduce costs.
 - (2) Most costly type of contract to administer.

11-2. Cost-Plus

- A. Explanation
 - (1) Supplies or services furnished at actual cost with no fee or profit allowed.
- B. Use
 - (1) When it is impossible to estimate costs with any degree of accuracy. Primarily used with research and development organizations.
- C. Advantages
 - (1) Identical to Cost-Plus-Fixed-Fee Contract.
- D. Disadvantages
 - (1) Identical to Cost-Plus-Fixed-Fee Contract.

11-3. Letter of Intent

- A. Explanation
 - (1) Supplies or services are furnished at an anticipated price. Pricing terms are negotiated when the letter of intent is converted into a definitive contract.

- B. Use
 - (1) When pricing terms cannot be agreed upon and the Government desires the contractor to commence work without delay.
 - (2) Insufficient historical cost data.
 - (3) Unique specifications.
- C. Advantages
 - (1) Provides quick contractual coverage.
- D. Disadvantages
 - (1) Legally it is not a satisfactory contract document.
 - (2) Additional administrative work.
 - (3) Danger of long time lag before conversion to a definitive contract.

IV—Nature of Award

- A. Explanation
 - (1) A TFX or letter does that specifies firm pricing terms, but leaves and specifications, but it encompasses all pricing by reference. Must be supported by a definitive contract.
- B. Use
 - (1) When prompt contractual coverage is required and all terms have been agreed upon.
- C. Advantages
 - (1) Prompt contractual coverage.
- D. Disadvantages
 - (1) Additional administrative work.
 - (2) Not as satisfactory legally as a firm contract.

Military Sales: Where to Go, Whom to See

DEPARTMENT OF THE AIR FORCE

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DU PONT AIRCRAFT RIVETS

DESIGNATION. For easy identification, Du Pont Aircraft Rivets are designated by a series of letters and numbers that positively defines the alloy, stock diameter in 1/1000 inch, head of head and nominal grip length in 1/100 inch. The following tables give the dimensions, maximum and minimum grip lengths and proper designations of the various line of Du Pont Aircraft Rivets.

ALUMINUM ALLOY OPEN TYPE (TABLE 1)

BRAZIER HEAD	Recommended Drill Size		Head		Stock Length 1/16"	Rivet Color	2017-T Aluminum Alloy		5056 Aluminum Alloy			
	Pilot	Rivet	Diam. size "A"	Width size "B"			Grip Range		Grip Range			
							Min.	Max.	Min.	Max.		
	1/16" ± .001"	FD 1/16" ± .001"	220 1/16"	220 ¹ ± .018"	000 ¹ ± .008"	Yellow	000 ¹	040 ¹	04-1304-4	000 ¹	040 ¹	505-1304-4
						Black	000 ¹	040 ¹	04-1304-4			
						Red	040 ¹	030 ¹	04-1304-8	040 ¹	040 ¹	505-1304-8
						Blue	040 ¹	160 ¹	04-1304-18			
						2200 Series	120 ¹	120 ¹	04-1304-12	040 ¹	120 ¹	505-1304-12
						5050 Yellow	130 ¹	140 ¹	04-1304-14			
						220 ¹	140 ¹	140 ¹	04-1304-16	120 ¹	140 ¹	505-1304-16
						220 ¹	180 ¹	180 ¹	04-1304-18			
						318 ¹	200 ¹	200 ¹	04-1304-20	140 ¹	200 ¹	505-1304-20
						318 ¹	220 ¹	220 ¹	04-1304-22			
						318 ¹	230 ¹	230 ¹	04-1304-23	340 ¹	240 ¹	505-1304-23
						318 ¹	240 ¹	240 ¹	04-1304-24			
						430 ¹	260 ¹	260 ¹	04-1304-26	340 ¹	260 ¹	505-1304-26
						430 ¹	280 ¹	280 ¹	04-1304-28			
						430 ¹	300 ¹	300 ¹	04-1304-30	340 ¹	300 ¹	505-1304-30
						430 ¹	320 ¹	320 ¹	04-1304-32	318 ¹	320 ¹	505-1304-32
						430 ¹	340 ¹	340 ¹	04-1304-34			
					430 ¹	360 ¹	360 ¹	04-1304-36				
					430 ¹	380 ¹	380 ¹	04-1304-38				
					430 ¹	400 ¹	400 ¹	04-1304-40				
					430 ¹	420 ¹	420 ¹	04-1304-42				
					430 ¹	440 ¹	440 ¹	04-1304-44				
					430 ¹	460 ¹	460 ¹	04-1304-46				
					430 ¹	480 ¹	480 ¹	04-1304-48				
					430 ¹	500 ¹	500 ¹	04-1304-50				
					430 ¹	520 ¹	520 ¹	04-1304-52				
					430 ¹	540 ¹	540 ¹	04-1304-54				
					430 ¹	560 ¹	560 ¹	04-1304-56				
					430 ¹	580 ¹	580 ¹	04-1304-58				
					430 ¹	600 ¹	600 ¹	04-1304-60				
					430 ¹	620 ¹	620 ¹	04-1304-62				
					430 ¹	640 ¹	640 ¹	04-1304-64				
					430 ¹	660 ¹	660 ¹	04-1304-66				
					430 ¹	680 ¹	680 ¹	04-1304-68				
					430 ¹	700 ¹	700 ¹	04-1304-70				
					430 ¹	720 ¹	720 ¹	04-1304-72				
					430 ¹	740 ¹	740 ¹	04-1304-74				
					430 ¹	760 ¹	760 ¹	04-1304-76				
					430 ¹	780 ¹	780 ¹	04-1304-78				
					430 ¹	800 ¹	800 ¹	04-1304-80				
					430 ¹	820 ¹	820 ¹	04-1304-82				
					430 ¹	840 ¹	840 ¹	04-1304-84				
					430 ¹	860 ¹	860 ¹	04-1304-86				
					430 ¹	880 ¹	880 ¹	04-1304-88				
					430 ¹	900 ¹	900 ¹	04-1304-90				
					430 ¹	920 ¹	920 ¹	04-1304-92				
					430 ¹	940 ¹	940 ¹	04-1304-94				
					430 ¹	960 ¹	960 ¹	04-1304-96				
					430 ¹	980 ¹	980 ¹	04-1304-98				
					430 ¹	1000 ¹	1000 ¹	04-1304-100				
					430 ¹	1020 ¹	1020 ¹	04-1304-102				
					430 ¹	1040 ¹	1040 ¹	04-1304-104				
					430 ¹	1060 ¹	1060 ¹	04-1304-106				
					430 ¹	1080 ¹	1080 ¹	04-1304-108				
					430 ¹	1100 ¹	1100 ¹	04-1304-110				
					430 ¹	1120 ¹	1120 ¹	04-1304-112				
					430 ¹	1140 ¹	1140 ¹	04-1304-114				
					430 ¹	1160 ¹	1160 ¹	04-1304-116				
					430 ¹	1180 ¹	1180 ¹	04-1304-118				
					430 ¹	1200 ¹	1200 ¹	04-1304-120				
					430 ¹	1220 ¹	1220 ¹	04-1304-122				
					430 ¹	1240 ¹	1240 ¹	04-1304-124				
					430 ¹	1260 ¹	1260 ¹	04-1304-126				
					430 ¹	1280 ¹	1280 ¹	04-1304-128				
					430 ¹	1300 ¹	1300 ¹	04-1304-130				
					430 ¹	1320 ¹	1320 ¹	04-1304-132				
					430 ¹	1340 ¹	1340 ¹	04-1304-134				
					430 ¹	1360 ¹	1360 ¹	04-1304-136				
					430 ¹	1380 ¹	1380 ¹	04-1304-138				
					430 ¹	1400 ¹	1400 ¹	04-1304-140				
					430 ¹	1420 ¹	1420 ¹	04-1304-142				
					430 ¹	1440 ¹	1440 ¹	04-1304-144				
					430 ¹	1460 ¹	1460 ¹	04-1304-146				
					430 ¹	1480 ¹	1480 ¹	04-1304-148				
					430 ¹	1500 ¹	1500 ¹	04-1304-150				
					430 ¹	1520 ¹	1520 ¹	04-1304-152				
					430 ¹	1540 ¹	1540 ¹	04-1304-154				
					430 ¹	1560 ¹	1560 ¹	04-1304-156				
					430 ¹	1580 ¹	1580 ¹	04-1304-158				
					430 ¹	1600 ¹	1600 ¹	04-1304-160				
					430 ¹	1620 ¹	1620 ¹	04-1304-162				
					430 ¹	1640 ¹	1640 ¹	04-1304-164				
					430 ¹	1660 ¹	1660 ¹	04-1304-166				
					430 ¹	1680 ¹	1680 ¹	04-1304-168				
					430 ¹	1700 ¹	1700 ¹	04-1304-170				
					430 ¹	1720 ¹	1720 ¹	04-1304-172				
					430 ¹	1740 ¹	1740 ¹	04-1304-174				
					430 ¹	1760 ¹	1760 ¹	04-1304-176				
					430 ¹	1780 ¹	1780 ¹	04-1304-178				
					430 ¹	1800 ¹	1800 ¹	04-1304-180				
					430 ¹	1820 ¹	1820 ¹	04-1304-182				
					430 ¹	1840 ¹	1840 ¹	04-1304-184				
					430 ¹	1860 ¹	1860 ¹	04-1304-186				
					430 ¹	1880 ¹	1880 ¹	04-1304-188				
					430 ¹	1900 ¹	1900 ¹	04-1304-190				
					430 ¹	1920 ¹	1920 ¹	04-1304-192				
					430 ¹	1940 ¹	1940 ¹	04-1304-194				
					430 ¹	1960 ¹	1960 ¹	04-1304-196				
					430 ¹	1980 ¹	1980 ¹	04-1304-198				
					430 ¹	2000 ¹	2000 ¹	04-1304-200				
					430 ¹	2020 ¹	2020 ¹	04-1304-202				
					430 ¹	2040 ¹	2040 ¹	04-1304-204				
					430 ¹	2060 ¹	2060 ¹	04-1304-206				
					430 ¹	2080 ¹	2080 ¹	04-1304-208				
					430 ¹	2100 ¹	2100 ¹	04-1304-210				
					430 ¹	2120 ¹	2120 ¹	04-1304-212				
					430 ¹	2140 ¹	2140 ¹	04-1304-214				
					430 ¹	2160 ¹	2160 ¹	04-1304-216				
					430 ¹	2180 ¹	2180 ¹	04-1304-218				
					430 ¹	2200 ¹	2200 ¹	04-1304-220				
					430 ¹	2220 ¹	2220 ¹	04-1304-222				
					430 ¹	2240 ¹	2240 ¹	04-1304-224				
					430 ¹	2260 ¹	2260 ¹	04-1304-226				
					430 ¹	2280 ¹	2280 ¹	04-1304-228				
					430 ¹	2300 ¹	2300 ¹	04-1304-230				
					430 ¹	2320 ¹	2320 ¹	04-1304-232				
					430 ¹	2340 ¹	2340 ¹	04-1304-234				
					430 ¹	2360 ¹	2360 ¹	04-1304-236				
					430 ¹	2380 ¹	2380 ¹	04-1304-238				
					430 ¹	2400 ¹	2400 ¹	04-1304-240				
					430 ¹	2420 ¹	2420 ¹	04-1304-242				
					430 ¹	2440 ¹	2440 ¹	04-1304-244				
					430 ¹	2460 ¹	2460 ¹	04-1304-246				
					430 ¹	2480 ¹	2480 ¹	04-1304-248				

*Dimension ±0.004" ±0.001"

Note—"N" diameter rivets should be accompanied with Dr. Part No. 75. Drawing 1001



DU PONT AIRCRAFT RIVETS

WHAT THEY ARE MADE OF

Du Pont Aircraft Rivets are available in 2017-T and 5056 (Du Pont Rivet designation 5056 and 5056 respectively) aluminum alloy, rivet and 5056 nuts.

The dimensions are shown to meet requirements.

For a complete list of rivet specifications, see "The Standard Rivet" or the rivet book and 100° counter-sunk rivet. This is a rivet with a head diameter .134", .211", .300", .380" and with a wide range of grip lengths. (See tables 1, 2 & 3)

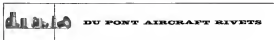
100° COUNTER-SUNK HEAD



ALUMINUM ALLOY OPEN TYPE (TABLE 2)





Rivet Size Part No.	Recommended Drill Size		Head		Grip Length Part No.	Rivet Color	2017-T Aluminum Alloy		5056 Aluminum Alloy	
	Pilot	Final	Diameter Part No.	Width Part No.			Grip Range		Grip Range	
							Min.	Max.	Min.	Max.
1/16" 2201 0.001	1/16"	1/16"	220	220	0001	1001	1001	5056-1304-4		
	1/16"	1/16"	220	220	0001	1001	1001	5056-1304-4		
	1/16"	1/16"	220	220	0001	1001	1001	5056-1304-4		
	1/16"	1/16"	220	220	0001	1001	1001	5056-1304-4		
	1/16"	1/16"	220	220	0001	1001	1001	5056-1304-4		
	1/16"	1/16"	220	220	0001	1001	1001	5056-1304-4		
	1/16"	1/16"	220	220	0001	1001	1001	5056-1304-4		
	1/16"	1/16"	220	220	0001	1001	1001	5056-1304-4		
	1/16"	1/16"	220	220	0001	1001	1001	5056-1304-4		
	1/16"	1/16"	220	220	0001	1001	1001	5056-1304-4		
	1/16"	1/16"	220	220	0001	1001	1001	5056-1304-4		
	1/16"	1/16"	220	220	0001	1001	1001	5056-1304-4		
	1/16"	1/16"	220	220	0001	1001	1001	5056-1304-4		
	1/16"	1/16"	220	220	0001	1001	1001	5056-1304-4		
	1/16"	1/16"	220	220	0001	1001	1001	5056-1304-4		
	1/16"	1/16"	220	220	0001	1001	1001	5056-1304-4		
1/8" 2202 0.001	1/8"	1/8"	220	220	0001	1001	1001	5056-1304-4		
	1/8"	1/8"	220	220	0001	1001	1001	5056-1304-4		
	1/8"	1/8"	220	220	0001	1001	1001	5056-1304-4		
	1/8"	1/8"	220	220	0001	1001	1001	5056-1304-4		
	1/8"	1/8"	220	220	0001	1001	1001	5056-1304-4		
	1/8"	1/8"	220	220	0001	1001	1001	5056-1304-4		
	1/8"	1/8"	220	220	0001	1001	1001	5056-1304-4		
	1/8"	1/8"	220	220	0001	1001	1001	5056-1304-4		
	1/8"	1/8"	220	220	0001	1001	1001	5056-1304-4		
	1/8"	1/8"	220	220	0001	1001	1001	5056-1304-4		
	1/8"	1/8"	220	220	0001	1001	1001	5056-1304-4		
	1/8"	1/8"	220	220	0001	1001	1001	5056-1304-4		
	1/8"	1/8"	220	220	0001	1001	1001	5056-1304-4		
	1/8"	1/8"	220	220	0001	1001	1001	5056-1304-4		
	1/8"	1/8"	220	220	0001	1001	1001	5056-1304-4		
	1/8"	1/8"	220	220	0001	1001	1001	5056-1304-4		
3/16" 2203 0.001	3/16"	3/16"	220	220	0001	1001	1001	5056-1304-4		
	3/16"	3/16"	220	220	0001	1001	1001	5056-1304-4		
	3/16"	3/16"	220	220	0001	1001	1001	5056-1304-4		
	3/16"	3/16"	220	220	0001	1001	1001	5056-1304-4		
	3/16"	3/16"	220	220	0001	1001	1001	5056-1304-4		
	3/16"	3/16"	220	220	0001	1001	1001	5056-1304-4		
	3/16"	3/16"	220	220	0001	1001	1001	5056-1304-4		
	3/16"	3/16"	220	220	0001	1001	1001	5056-1304-4		
	3/16"	3/16"	220	220	0001	1001	1001	5056-1304-4		
	3/16"	3/16"	220	220	0001	1001	1001	5056-1304-4		
	3/16"	3/16"	220	220	0001	1001	1001	5056-1304-4		
	3/16"	3/16"	220	220	0001	1001	1001	5056-1304-4		
	3/16"	3/16"	220	220	0001	1001	1001	5056-1304-4		
	3/16"	3/16"	220	220	0001	1001	1001	5056-1304-4		
	3/16"	3/16"	220	220	0001	1001	1001	5056-1304-4		
	3/16"	3/16"	220	220	0001	1001	1001	5056-1304-4		
1/2" 2204 0.001	1/2"	1/2"	220	220	0001	1001	1001	5056-1304-4		
	1/2"	1/2"	220	220	0001	1001	1001	5056-1304-4		
	1/2"	1/2"	220	220	0001	1001	1001	5056-1304-4		
	1/2"	1/2"	220	220	0001	1001	1001	5056-1304-4		
	1/2"	1/2"	220	220	0001	1001	1001	5056-1304-4		
	1/2"	1/2"	220	220	0001	1001	1001	5056-1304-4		
	1/2"	1/2"	220	220	0001	1001	1001	5056-1304-4		
	1/2"	1/2"	220	220	0001	1001	1001	5056-1304-4		
	1/2"	1/2"	220	220	0001	1001	1001	5056-1304-4		
	1/2"	1/2"	220	220	0001	1001	1001	5056-1304-4		
	1/2"	1/2"	220	220	0001	1001	1001	5056-1304-4		
	1/2"	1/2"	220	220	0001	1001	1001	5056-1304-4		
	1/2"	1/2"	220	220	0001	1001	1001	5056-1304-4		
	1/2"	1/2"	220	220	0001	1001	1001	5056-1304-4		
	1/2"	1/2"	220	220	0001	1001	1001	5056-1304-4		
	1/2"	1/2"	220	220	0001	1001	1001	5056-1304-4		

*Dimension ±0.004" ±0.001"



ALUMINUM ALLOY SEALED TYPE (TABLE 3)

5056 ALUMINUM

BRAZIER HEAD	Rivet Size "D"	Recommended Rivet Size		Head		Mark Length "L"	Rivet Color	Rivet Range		Rivet Number
		Flat	Flush	Standard "A"	Unusually "B"			Min	Max	
	1/4" .171" ±.001"	Ø10 or smaller	Ø10	210° ±.010"	Ø100 ±.003"	210°	Yellow	200°	240°	FS10-134A-4
				210°	Ø100	210°	Red	240°	280°	FS10-134A-8
				210°	Ø100	210°	Brown	280°	320°	FS10-134A-12
				210°	Ø100	210°	Black	320°	360°	FS10-134A-16
				210°	Ø100	210°	Blue	360°	400°	FS10-134A-20
				210°	Ø100	210°	Yellow	400°	440°	FS10-134A-24
				210°	Ø100	210°	Red	440°	480°	FS10-134A-28
				210°	Ø100	210°	Black	480°	520°	FS10-134A-32
				210°	Ø100	210°	Blue	520°	560°	FS10-134A-36
				210°	Ø100	210°	Yellow	560°	600°	FS10-134A-40
				210°	Ø100	210°	Red	600°	640°	FS10-134A-44
	1/2" .321" ±.001"	Ø12 or smaller	Ø12	210° ±.010"	Ø100 ±.003"	210°	Yellow	200°	240°	FS10-134A-4
				210°	Ø100	210°	Red	240°	280°	FS10-134A-8
				210°	Ø100	210°	Brown	280°	320°	FS10-134A-12
				210°	Ø100	210°	Black	320°	360°	FS10-134A-16
				210°	Ø100	210°	Blue	360°	400°	FS10-134A-20
				210°	Ø100	210°	Yellow	400°	440°	FS10-134A-24
				210°	Ø100	210°	Red	440°	480°	FS10-134A-28
				210°	Ø100	210°	Black	480°	520°	FS10-134A-32
				210°	Ø100	210°	Blue	520°	560°	FS10-134A-36
				210°	Ø100	210°	Yellow	560°	600°	FS10-134A-40
	3/4" .471" ±.001"	Ø14 or smaller	Ø14	210° ±.010"	Ø100 ±.003"	210°	Yellow	200°	240°	FS10-134A-4
				210°	Ø100	210°	Red	240°	280°	FS10-134A-8
				210°	Ø100	210°	Brown	280°	320°	FS10-134A-12
				210°	Ø100	210°	Black	320°	360°	FS10-134A-16
				210°	Ø100	210°	Blue	360°	400°	FS10-134A-20
				210°	Ø100	210°	Yellow	400°	440°	FS10-134A-24
				210°	Ø100	210°	Red	440°	480°	FS10-134A-28
				210°	Ø100	210°	Black	480°	520°	FS10-134A-32
				210°	Ø100	210°	Blue	520°	560°	FS10-134A-36
				210°	Ø100	210°	Yellow	560°	600°	FS10-134A-40
	1" .621" ±.001"	Ø16 or smaller	Ø16	210° ±.010"	Ø100 ±.003"	210°	Yellow	200°	240°	FS10-134A-4
				210°	Ø100	210°	Red	240°	280°	FS10-134A-8
				210°	Ø100	210°	Brown	280°	320°	FS10-134A-12
				210°	Ø100	210°	Black	320°	360°	FS10-134A-16
				210°	Ø100	210°	Blue	360°	400°	FS10-134A-20
				210°	Ø100	210°	Yellow	400°	440°	FS10-134A-24
				210°	Ø100	210°	Red	440°	480°	FS10-134A-28
				210°	Ø100	210°	Black	480°	520°	FS10-134A-32
				210°	Ø100	210°	Blue	520°	560°	FS10-134A-36
				210°	Ø100	210°	Yellow	560°	600°	FS10-134A-40

Note—1/4" diameter rivets should be expanded with Du Pont No. 7A Brazing Gun.

100° COUNTER-SUNK HEAD

5056 ALUMINUM

	Rivet Size "D"	Recommended Rivet Size		Head		Mark Length "L"	Rivet Color	Rivet Range		Rivet Number
		Flat	Flush	Standard "A"	Unusually "B"			Min	Max	
	1/4" .171" ±.001"	Ø10 or smaller	Ø10	210° ±.010"	Ø100 ±.003"	210°	Yellow	200°	240°	FS10-134-100-8
				210°	Ø100	210°	Red	240°	280°	FS10-134-100-12
				210°	Ø100	210°	Brown	280°	320°	FS10-134-100-16
				210°	Ø100	210°	Black	320°	360°	FS10-134-100-20
				210°	Ø100	210°	Blue	360°	400°	FS10-134-100-24
				210°	Ø100	210°	Yellow	400°	440°	FS10-134-100-28
				210°	Ø100	210°	Red	440°	480°	FS10-134-100-32
				210°	Ø100	210°	Black	480°	520°	FS10-134-100-36
				210°	Ø100	210°	Blue	520°	560°	FS10-134-100-40
	1/2" .321" ±.001"	Ø12 or smaller	Ø12	210° ±.010"	Ø100 ±.003"	210°	Yellow	200°	240°	FS10-134-100-8
				210°	Ø100	210°	Red	240°	280°	FS10-134-100-12
				210°	Ø100	210°	Brown	280°	320°	FS10-134-100-16
				210°	Ø100	210°	Black	320°	360°	FS10-134-100-20
				210°	Ø100	210°	Blue	360°	400°	FS10-134-100-24
				210°	Ø100	210°	Yellow	400°	440°	FS10-134-100-28
				210°	Ø100	210°	Red	440°	480°	FS10-134-100-32
				210°	Ø100	210°	Black	480°	520°	FS10-134-100-36
				210°	Ø100	210°	Blue	520°	560°	FS10-134-100-40
				210°	Ø100	210°	Yellow	560°	600°	FS10-134-100-44
	3/4" .471" ±.001"	Ø14 or smaller	Ø14	210° ±.010"	Ø100 ±.003"	210°	Yellow	200°	240°	FS10-134-100-8
				210°	Ø100	210°	Red	240°	280°	FS10-134-100-12
				210°	Ø100	210°	Brown	280°	320°	FS10-134-100-16
				210°	Ø100	210°	Black	320°	360°	FS10-134-100-20
				210°	Ø100	210°	Blue	360°	400°	FS10-134-100-24
				210°	Ø100	210°	Yellow	400°	440°	FS10-134-100-28
				210°	Ø100	210°	Red	440°	480°	FS10-134-100-32
				210°	Ø100	210°	Black	480°	520°	FS10-134-100-36
				210°	Ø100	210°	Blue	520°	560°	FS10-134-100-40
				210°	Ø100	210°	Yellow	560°	600°	FS10-134-100-44
	1" .621" ±.001"	Ø16 or smaller	Ø16	210° ±.010"	Ø100 ±.003"	210°	Yellow	200°	240°	FS10-134-100-8
				210°	Ø100	210°	Red	240°	280°	FS10-134-100-12
				210°	Ø100	210°	Brown	280°	320°	FS10-134-100-16
				210°	Ø100	210°	Black	320°	360°	FS10-134-100-20
				210°	Ø100	210°	Blue	360°	400°	FS10-134-100-24
				210°	Ø100	210°	Yellow	400°	440°	FS10-134-100-28
				210°	Ø100	210°	Red	440°	480°	FS10-134-100-32
				210°	Ø100	210°	Black	480°	520°	FS10-134-100-36
				210°	Ø100	210°	Blue	520°	560°	FS10-134-100-40
				210°	Ø100	210°	Yellow	560°	600°	FS10-134-100-44

Note—1/4" diameter rivets should be expanded with Du Pont No. 7A Brazing Gun.

*Subject to evolution due to marketing.



5056 aluminum alloy rivets are manufactured with unusually wide gap ranges so that each size rivet can be used for a wide range of material thickness. (See above.) This reduces the number of separate rivets needed for most jobs and simplifies stock inventory.

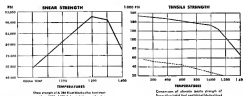
All sizes of 308 and nickel rivets are

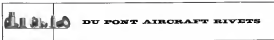
manufactured in the sealed type. These have a metal plug in the end of the cavity containing the chemical charge. They are widely used in honeycomb structures because they eliminate the blast which might possibly deform these delicate elements. Sealed rivets are practically noncorrosive when being set.

RIVETS FOR HIGH-TEMPERATURE APPLICATIONS

Nickel rivets (see table 4) are available in .104", .171" and .203" diameters. These were given general service approval on 7-36-50 Letter No. MCAREN A71 and are currently being used in the manufacture of military aircraft.

The most recent addition to the Du Pont Aircraft Rivet line is the Du Pont A-286 Superalloy Aircraft Rivet for high-temperature applications. (See table 5.) This rivet retains its strength, both shear and tensile, up to 1,400°F. (See graphs below.)





HIGH-TEMPERATURE RIVETS (TABLE 4)

L NICKEL OPEN TYPE

Rivet Size "Ø"	Recommended Drill Size		Head		Mechanical Grip "L"	Grip Range		Max. Length "L"	Rivet Number
	Fillet	Flush	Flange 1/4"	Thickness 1/8"		Min.	Max.		
1/4" 134"	1/32 or smaller	1/32 134"	250"	250"	1/2"	175"	175"	16 134 x 1/4	
					1/2"	175"	175"	16 134 x 1/4	
					1/2"	175"	175"	16 134 x 1/4	
1/2" 171"	1/32 or smaller	1/32 171"	312"	312"	1/2"	237"	237"	16 171 x 1/2	
					1/2"	237"	237"	16 171 x 1/2	
					1/2"	237"	237"	16 171 x 1/2	
3/4" 203"	1/32 or smaller	1/32 203"	375"	375"	1/2"	299"	299"	16 203 x 3/4	
					1/2"	299"	299"	16 203 x 3/4	
					1/2"	299"	299"	16 203 x 3/4	

BRAZIER HEAD



100° COUNTER-SUNK HEAD



1/4" 134"	1/32 or smaller	1/32 134"	216"	216"	1/2"	151"	151"	16 134 x 1/4	
1/2" 171"	1/32 or smaller	1/32 171"	278"	278"	1/2"	213"	213"	16 171 x 1/2	
3/4" 203"	1/32 or smaller	1/32 203"	340"	340"	1/2"	275"	275"	16 203 x 3/4	

L NICKEL SEALED TYPE

BRAZIER HEAD



1/4" 134"	1/32 or smaller	1/32 134"	250"	250"	1/2"	175"	175"	16 134 x 1/4	
1/2" 171"	1/32 or smaller	1/32 171"	312"	312"	1/2"	237"	237"	16 171 x 1/2	
3/4" 203"	1/32 or smaller	1/32 203"	375"	375"	1/2"	299"	299"	16 203 x 3/4	

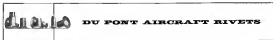
100° COUNTER-SUNK HEAD



1/4" 134"	1/32 or smaller	1/32 134"	216"	216"	1/2"	151"	151"	16 134 x 1/4	
1/2" 171"	1/32 or smaller	1/32 171"	278"	278"	1/2"	213"	213"	16 171 x 1/2	
3/4" 203"	1/32 or smaller	1/32 203"	340"	340"	1/2"	275"	275"	16 203 x 3/4	

*Base dimensions are subject to small plus or minus tolerances.

**Brazing is required due to seeping.



HIGH-TEMPERATURE RIVETS (TABLE 5)

A-286 SUPERALLOY OPEN TYPE

Rivet Size "Ø"	Recommended Drill Size		Head		Mechanical Grip "L"	Grip Range		Max. Length "L"	Rivet Number
	Fillet	Flush	Flange 1/4"	Thickness 1/8"		Min.	Max.		
1/4" 134"	1/32 or smaller	1/32 134"	250"	250"	1/2"	175"	175"	16 134 x 1/4	
					1/2"	175"	175"	16 134 x 1/4	
					1/2"	175"	175"	16 134 x 1/4	
1/2" 171"	1/32 or smaller	1/32 171"	312"	312"	1/2"	237"	237"	16 171 x 1/2	
					1/2"	237"	237"	16 171 x 1/2	
					1/2"	237"	237"	16 171 x 1/2	
3/4" 203"	1/32 or smaller	1/32 203"	375"	375"	1/2"	299"	299"	16 203 x 3/4	
					1/2"	299"	299"	16 203 x 3/4	
					1/2"	299"	299"	16 203 x 3/4	

BRAZIER HEAD



100° COUNTER-SUNK HEAD



1/4" 134"	1/32 or smaller	1/32 134"	250"	250"	1/2"	175"	175"	16 134 x 1/4	
1/2" 171"	1/32 or smaller	1/32 171"	312"	312"	1/2"	237"	237"	16 171 x 1/2	
3/4" 203"	1/32 or smaller	1/32 203"	375"	375"	1/2"	299"	299"	16 203 x 3/4	

*Tolerance +0.004" -0.002"

† Explanatory Items



DU PONT AIRCRAFT RIVETS

RIVET STRENGTH DATA

Aircraft Design Allowable Loads for Du Pont Aircraft Rivets are listed in the latest revised issue of the *ANC-5 Technical Sub-committee's* publication, "Strength of Metal Aircraft Elements," dated June 1951. This publication may be obtained by writing to the Superintendent of Documents,

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Complete strength data on all Du Pont Aircraft Rivets may be obtained by writing to the address below.

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Broken line shows how airplane passed between storm cells in its flight path.



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RCA is proud that these distinguished air lines have chosen the AVQ-10 to save time and increase passenger comfort. Every effort will be made to meet additional commitments occasioned by the great and growing demand for this equipment. To assure early installation, other air line and private operators are invited to write immediately for further particulars on the RCA AVQ-10. Overseas customers should get in touch with the RCA International Division, 50 Rockefeller Plaza, New York City, or any RCA International Distributor.



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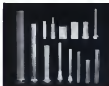
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AVIATION WEEK BUYER'S GUIDE - SECTION A

The shapes in the sky are unusual. But within the glowering outlines are the ordinary pieces that have formed airplanes for fifty years: alloys and adhesives, nuts and nutsplines, tanks and tubing.

AIRCRAFT





ENGINE 8-32 Time set for symposium used as subcontractors briefed and money, paid the cost in payroll time savings.

Symposium Saves Contract Time

Seattle, Wash.—Subcontractors, real and potential, no longer have to make several trips to the Boeing Aircraft Company to find out what they can make and how to do it. At both Seattle and Wichita, Kansas, the company is holding classes to get the word out in a minimum of time, with a minimum of effort.

The system, inaugurated more than a year ago for work on the KC-119 Stratotanker and the B-52 Stratofortress, was a symposium similar to the ones recently inaugurated by the Air Research & Development Command (AWR, Oct. 15, p. 11). ARDC seeks to stimulate development work by contractors. Boeing's goal is to answer all the questions at one time, make sure everybody knows the right answers.

In the case of the new Air Force tanker, more than 40 pct. of the work is being subcontracted. Under the old system, specifications were sent to interested manufacturers and then those as it was up to them to dig for information.

This involved, in some cases, many trips to a Boeing plant. It took up Boeing's engineers to individual contractors, most of them meeting a performance already stipulated for other people.

In addition, it also was inefficient and wasteful from the subcontractor's viewpoint. Top company officials and engineers spent time and money seeking data, interpretations and answers of problems. Not infrequently, it was impossible to get a contract, but this was not known until the item had been fully explored.

Subcontract Symposium

Now a symposium is held for each subcontract for a major assembly as related group of items assembled. All interested bidders are invited to attend for two-day sessions.

Bids are given by top Boeing personnel in purchasing, design engineering, industrial engineering, manufacturing, test and production planning and traffic. Shides and movies are utilized and the aircraft prototype is studied.

Each guest gets a typed copy of the entire proceedings, including all the questions and answers. Thus they all have the same complete information.

Says Frank Dahlberg, general manager of Boeing's Seattle Division:

"We furnished more complete information in one day than we had pre-

viously in much longer periods. When we looked up the cost we found that there was little difference.

"Our savings in payroll time affect the cost of the symposium. Of greatest importance was the fact that we saved two days in time on each subcontract."

Boeing Mentors

Where bids are in, a team of Boeing men goes to the plant of the lowest bidder in at least once to the plants of several low bidders. They inspect the facilities, make sure the job will be done.

Next, the company's quality control experts maintain liaison with the subcontractor's plant for duration of the job.

The symposium system is of almost benefit to small business concerns and they get special attention from Boeing on both the B-52 and KC-119 projects. In the case of the B-52, there are 4,500 subcontractors and suppliers in 42 states. Of these, 1,500-77 percent—use firms employing fewer than 500 persons.

Boeing figures show that out of every ten dollar spent for their aircraft, USAF pays 35 cents directly to subcontractors of government furnished equipment. Of the 72 cent paid to Boeing, 47 is paid along to subcontractors and suppliers. Only 25 cents stays with Boeing for its own operations.

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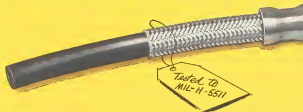
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*Du Pont trademark for tetrafluoroethylene resin.

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3,000 psi compressors rated to 11.2 cfm free air equivalent



Turbine Drives

For Alternators, Hydraulic Pumps and Emergency Power



Mechanical Drive Fuel Tank Tests

Predefined Properties



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Pneumatic—for Temperature, Flow and Pressure Regulation

With manufacturing facilities on both the east and west coasts, Stratos is integrating many more products into its line of aircraft systems and accessory equipment.

In addition to pressurization and air-conditioning systems for aircraft, Stratos is now supplying high and low pressure compressors, turbo drives, valves and controls—a more complete group of pneumatic accessories and systems for many basic aircraft services.



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Model PCM 3,000 cc Compressor,
Delivers 10.2 cfm Free Air Equivalent



Model TP2 Turbine Drive
for 15 to 25 Amp Alternators



Model TP2-2 Turbine Drive
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Mechanical Fuel Regulator



Model TP3 Turbine-Generator
Emergency Power Unit



Model T24 Fueling Unit,
Capacity: 500 gals.



Model T24 Fueling Unit



Model RT Radio Unit
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Model T24 Fueling Unit



Model T24 Fueling Unit



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Compressor, 2 cfm, 1,200 psi
self-contained, electricity or gas



Model C235 Refrigeration System—
Normal Flow Rating: 15 ton/min.



Model S26-1 Cabin Supercharger



Model S26-5 Cabin Supercharger



Model S26-5 Cabin Supercharger



Model H25 Air Cycle Machine



Model H25 Air Cycle Machine



Ball Valve for
High Temperature

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Cessna T-400	North XP46-L, G-37B
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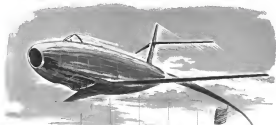
Plexiglas is a trademark, Reg. U.S. Pat. Off. and is also principal material in the Western (Bendheim) Division (Bendheim) Crystal Glass & Plastic Co., 150 Queen's Quay at Avenue St., Toronto, Ontario.



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- Auxiliary power units
- Boundary layer control

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Output: 10 volts at full scale
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Precision: 1 x 10⁻⁴ g-sec.
Zero stability: Better than 1 x 10⁻⁴ g-sec.
Write for Bulletin 1948



■ RESISTANCE RANGE PRESSURE PICKUP

Sensitivity: 5 mV/psi at full scale
Range: 0-10 to 0-1000 psi
Type: Absolute and differential
Construction: Hermetically sealed
Write for Bulletin No. 7



■ UNIT OF TIME

Outputs 1 volt signal and/or disk rotation
Range: 0-10000 rpm
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A-28



Superior Tube Offers the Finest in Small Diameter Precision Tubing for Aircraft Uses

Choice of over 63 analyses, wide variety of shapes and sizes, all made to close tolerances

Large OD lightweight tubing is seamless and "Weldweld" (welded and drawn). For applications of aircraft structures, aircraft flexible metal hoses, low-pressure fuel exchangers, aircraft ducting, bellows. The seamless tubing is offered in AISI Types 304, 321 and 347, and Inconel 600. Produced in pickled or cold drawn finish and in fully annealed, full-hard, full-hard drawn, or intermediate temper. Length 5 to 32 ft in random, multiple or cut lengths.

AVAILABLE SIZES IN SEAMLESS TUBING

OD	Minimum wall	Maximum wall
1/8" to 1/2" inc.	.006"	.020"
3/4"	.007"	.020"
1 1/4"	.008"	.020"
1 3/4" to 2 1/4"	.010"	.020"
2 3/4" to 3 1/2"	.010"	.020"

Weldweld tubing is offered in Types 304 and 321 with max. length of 28 ft. Available sizes up to 2 1/2" OD. Wall thickness tolerance is $\pm .005$ on all sizes.

High-quality aircraft stainless hydraulic tubing. For tubing applications to withstand pressures as high as 12,000 psi. Featuring qualities for bending without kinking and flexing. Superior hydraulic tubing is 100% hydrostatically tested as well as stress tested under 10X magnification.

Every length (1/4" OD and larger) of

seamless hydraulic tubing is continuously marked—analysis, heat number, size, specification. Tubing is thoroughly cleaned in standard pickling solutions for maximum ductility and freedom from scale film and inclusions. Seamless tubing is offered in various AISI Types 304, 321, 347 and 400. Sizes range 1/8" to 1 1/2" OD with maximum walls of 1/4" and 1 1/2" to 2 1/2" OD—maximum wall .020".

Stainless tubing. For structural applications, refrigeration and air conditioning lines, hydraulic and pneumatic lines. This alloy has a low linear coefficient of expansion, good ductility and formability and high resistance to corrosion and oxidation. Featuring high strength to weight ratio, it is available in seamless, Weldweld, and as tube sections.

Sizes range from .812" to 1.375" OD, wall thickness .002" to .125". Max. length 36 ft.

High temperature alloy tubing. For gas turbines, gas turbines, jet engines, other aircraft tubing exposed to high temperatures. Superior offers the tubing in stainless steel, nickel, and a variety of super alloys. Available in round or shaped tubing with commercial tolerances every 1/8" of all requirements. Stress analyses Types 321 and 347 are used for welding where parts cannot

be subsequently stressed—aircraft hydraulic and engine fuel lines.

AISI 403, a low-alloy steel, is used for aircraft structures and engine parts. In annealed condition, it has good workability and can be hardened by heat treatment.

Low carbon steel tubing is produced to AMS 8980—used for engine fuel and oil lines.

Superior presents quality in well as wide choice in tubing. Close control and application of modern testing facilities throughout the manufacturing process assure the aircraft manufacturer of tubing to meet the most exacting requirements.

Providing direct and general service to manufacturers on the West Coast, Pacific Tube Company, Los Angeles, offers the complete line of Superior tubing.

For detailed information about Superior tubing, including analyses for the aircraft industry, write for Bulletin 40 Address Superior Tube Co., 3201 Garfield Ave., Norwalk, Pa., or Pacific Tube Co., 1710 Southview St., Los Angeles 22.

Round and shaped tubing available in Carbon, Alloy and Stainless Steels, Nickel and Nickel Alloy, Inconel, Copper, Titanium, Zirconium.

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the big name in small tubing

West Coast: Pacific Tube Company

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All analyses .020" to 1/4" OD. Carbon steel analysis in light walls up to 2 1/2" OD

A-30

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The first afterburner fuel controls in the aviation industry were developed and produced by Challenger-Dodge. The basic GEICO Afterburner Control is a bypass type regulator operating on a constant pressure basis across a variable orifice. Size of the orifice is regulated by the airflow parameter throttle mode

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Provide geometric metering of fuel for all conditions of rpm, altitude and airspeed. Manually selected bypass circuit is automatically controlled so that the desired thrust is allowed in the shortest possible time consistent with conditions for proper engine operation.

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Can be manually or automatically, shut valve over the emergency fuel line in the event of fuel damage or other emergency. Like many main fuel controls, this is a pressure regulating bypass system.



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Kawneer engineers have broad experience coupled with initiative and drive to efficiently translate your requirements into a finished product. The department is frequently expanded in scope to give you the best possible service. Proven Engineering, Freezing, Tool Control, Tool Inspection and Layout, and Development.
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Actionflex

Fiberglass-Silicone

Memo

To: Chief Engineer, Plant No. 4
From: Field Engineering Office
Subject: Actionflex Field Report #55-137

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Result: Initial Actionflex assembly immediately solved problem, assembly life lengthened to 900 engine hours. Further Actionflex engineering design lengthened assembly life to 1000 engine hours, and reduced cost of the assembly by 1/3.

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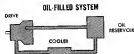
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DOUGLAS A-10 THUNDERBOLT II USES LIGHTWEIGHT GENERAL ELECTRIC CONSTANT SPEED DRIVE.

How G-E constant speed drive's unique design improves Bantam A-bomber performance

The unique ball piston design of the General Electric G-EVA hydraulic constant speed drive improves the performance of the Douglas A-10 Skyhawk by providing a more reliable drive of reduced weight and size. The simplicity and symmetry of the few moving parts also permit the drive to run "full of oil" in a completely oil-filled system.



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- LESS WEIGHT** no scavange pump or vent line required
- SMALL OIL RESERVOIR** no space needed for desiccant
- ALL-ATTITUDE OPERATION** not affected by aircraft maneuvers
- SIMPLIFIED COOLING** circulating oil cools all drive components
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VERSATILE 9 KVA DRIVE allowed addition of starting pump in A-10 application.

The General Electric hydraulic constant speed drive is currently being built in 9 and 10 KVA sizes. Drives can be built up to 60 KVA covering a wide range of speeds and many design variations.

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PSP has developed DC solenoids that withstand actual fuel tank pressures to 7,000 psi and operate at pressures to 1,500 psi in the plunger cavity—while withstanding ambient temperatures to 500°F! Other features: symmetrically balanced plungers, precision adjustable plunger stroke, maximum duty operation at 50 Vdc DC. Required also in a pull type to meet all requirements of precision aircraft valve operation.

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HIGH VOLTAGE TYPES?

PSP now provides direct current solenoids in the 60-125 Volt range for the engineering of new electronic control systems on computers, missiles and aircraft. These high voltage units provide several important advantages: the same power can be obtained with less current, savings in weight can be realized, switching from mechanical to electronic control can be accomplished without extraordinary equipment. Made in both single and double end and pull or pull types for all requirements.

MINIATURES?

These little PSP solenoids run the big game in cost patterns, money units and other electronic control units! They are made in a range of types for all applications requiring short strokes. Models are available with stroke adjustable to an accuracy of plus or minus 0.002", having the exact control required for precise instruments, for accurately opening and closing valves, etc.

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pace with the industry, it is an organization to name that in industry after: aircraft in the fields of fuel metering, landing gear, wheels and brakes. Bendix sets the pace by developing making possible greater speeds, heavier loads and increased safety.

Thus, today, Bendix Products accumulates knowledge of research, engineering and manufacturing offers to air frame builders and engine manufacturers the best solutions to better products, quicker deliveries and lower costs in fuel metering, landing gear, wheels, brakes, and components.

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"MONOBALL" Self-Aligning Bearings



CHARACTERISTICS

ANALYSIS

1. Precision Steel Ball and Race
2. Chrome duty Steel Ball and Race
3. Bronze duty Chrome duty Steel Ball

DISADVANTAGES

For types requiring under high torque (types 200-250 diameters 7")

For types requiring under high torque (diameters 200-250 PSI for 1")

For types requiring under normal loads with minimum friction requirements

Thousands in use. Backed by years of service life. Wide variety of Flats Types in bore sizes 1/32" to 6" Dia. Ball and race types in similar size range with externally or internally threaded flanges. One bearing replaces an assembly of rotating shaft-hub requirements and providing a type of type which will serve under any assembling conditions. Southwest can design special types to fit individual specifications. As a result of thorough study of different operating conditions, various steel alloys have been used to meet specific needs. Write for detailed Engineering Manual describing complete line. Address Dept. A-77-20

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push-pull CONTROLS



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1. Light Duty—Compresses 40' Lead 1250 lbs., 25' tension 540 lbs.
2. Heavy Duty—Compresses 40' Lead 1400 lbs., 25' tension 540 lbs.
3. Extra Heavy Duty—Compresses 40' Lead 3000 lbs., 25' tension 2500 lbs.

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New process helps save up to 5 pounds on G-E jet ignition systems

A new manufacturing process that uses a hard setting foam to seal capacitor discharge jet ignition components is being used at General Electric. Weight of the system is greatly reduced, as lightweight foam replaces heavy component supports. The sealing foam also provides better vibration and shock resistance.

As a result of experience gained in producing thousands of jet ignition systems, G.E. has made many other design improvements. For instance, miniaturized components are used to reduce size and weight, rounded electrode and semi-conducting insulator increases efficiency of spark plugs, and improved capacitors provide increased spark energy. **FOR DETAILED INFORMATION** on General Electric capacitor discharge jet ignition systems, contact your G-E Appointments Sales Office, or write to: Section 39-11, General Electric Co., Schenectady 5, New York.



NEW G-E SPARK GENERATOR (right) is 3 pounds less than former model (left) and has increased spark energy.



IMPROVED LEAD AND FLUX (center) greatly increases available spark energy and reduces system weight 9 pounds.

THESE LIGHTWEIGHT JET IGNITION SYSTEMS AVAILABLE FROM G.E.

SPARK TYPE	POWER INPUT	VOLTAGE OUTPUT	ENERGY PER PULSE (joules)	NUMBER OF PULSES PER SECOND	SCHEMATIC SYSTEM WEIGHT (POUNDS)
S-3 BA	4-6	low v	1.8	1	3.4
S-3 PC	4-6	low v	3.4	1	3.4
S-3 DA	4-6	high v	3.4	1	5.5
P-3 BA	4-6	low v	1.1	3	4.7
P-3 DA	4-6	high v	1.1	4	9.1
S-3 DA	4-6	low v	3.0	2	7.5

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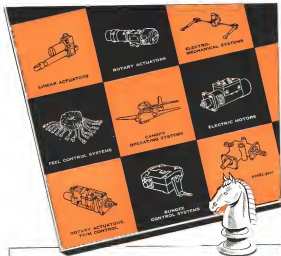
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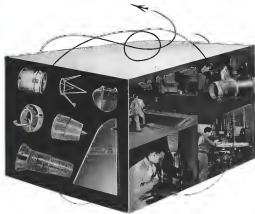
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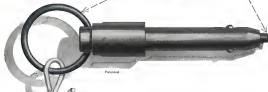
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10-32 through 16-48
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Made of aircraft alloy steel, customer plated
Supplied untreated or with drilled shafts



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Made of aircraft alloy steel, cadmium plated.
They are self-locking nuts with internal
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located through the body of the nut and
contacting the threads of the bolt.



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Made of aircraft alloy steel. One-piece, self-
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Positive locking is accomplished by the
slanted locking section which locks on the
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AN-361 6-32 through 1/2-20
AN-362 6-32 through 1/2-20
AN-363 6-32 through 1/2-20
AN-364 6-32 through 1/2-20
Proven Patent Specification AN-N-2600
is listed on NAS 440 and
AN-N-2600.
AN-361 and AN-362 nuts are made of
steel, cadmium plated. They are designed
for temperatures to 550°F. AN-363, nuts
are made of corrosion resistant steel, a steel
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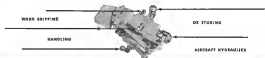
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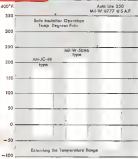
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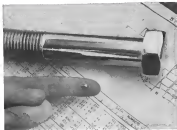


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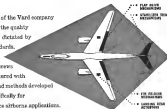


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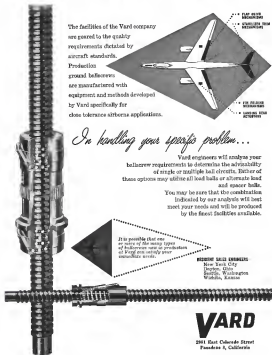
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AVI-100

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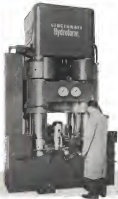
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Double End Cylinder - 2000 psi
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When a manufacturer gains the reputation of being a primary source for any product, it is usually indicative that they have the "know how" and facilities to produce at competitive prices.

The ability to produce the smallest to the largest, the simplest to the most complex cylinders has made Loud the source for high quality - low priced units.

In addition to making the ordinary actuating cylinder, Loud produces units containing integral mechanical locking devices, snubbing cylinders, power control booster cylinders, as well as a patented mechanical locking cylinder adaptable to many applications where the load is required to be firmly held without pressure and yet easily unlatched and moved hydraulically or pneumatically.

Alloy Steel Cylinder - 2000 psi
3 1/2" dia x 1 1/2" stroke



Alloy Steel Cylinder - 2000 psi
3 1/2" dia x 1 1/2" stroke



Alloy Steel Cylinder - 2000 psi
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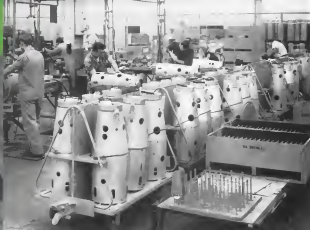
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MISSILES



There is no cockpit, no pilot. Instead there is built-in intelligence crammed into black boxes. There are non-atomic take-off and land, chemical fuels for supersonic propulsion. Underneath are the familiar elements of an airplane.



MACHINED PARTS, such as these air guidance sections for the Convair-built Terrier, comprise major sections of today's missiles.



FABRICATED FINs, typified by this early Macho Viking, represent a needed missile manufacturing technique.

Technical Progress Boosts Missile Buying

By David A. Anderson

Guided missiles and supporting services will be bought at a rate approximating one billion dollars per year for the next five years.

During the past decade, and starting from almost nothing, the money allotted annually for missile procurement has been rising rapidly until today it has touched the \$700-million mark. A total expenditure near six billion dollars has been estimated for the missile program to date; the future growth is limited only by the rate of technological expansion possible in missile development.

Actually, the division of missile funds allocated to procurement or research and development is difficult to isolate. Each of the military services supports a large research and development program whose results may be applicable to both the planned and planned state of research. There is no obvious way of separating the cost of a new sword thrust at a government facility to military or aircraft.

Procurement programs may also. The Army, for example, buys its missile procurement money together with its funds for ammunition for all uses of rifle, artillery and rocket launchers.



FALCON cradles small missile.

Thus the billion dollar annual figure is an estimate, but in the light of current trends in procurement, a realistic one.

The lion's share of that money is used now for actual purchase of missiles for training and standby use for existing missiles. There is a renewal of the situation at the beginning of the decade, when almost all of the money was rights chartered into development.

Size in Service

The weapons arsenal of the U. S. military services now stacks about half dozen operational missiles, with several more about to leave developmental status for production. Three of these have advanced to the point where they are regarded as capable of being introduced to American units stationed in NATO countries.

Total number of active missile programs is about 24, but contractors are extremely wide range of missiles, test and complexities.

These are four fundamental categories established in guides for missile design in the country.

- **Air-to-air, for fighter and bomber weapons.** These are small missiles, generally of a size and weight that can be installed on the ground. The powerplant is generally a subsonic, but rocket motor. Intelligence may be contained within the missile, or it may be contained in the master plane and transmitted in the missile. Typical examples of this category are the Hughes Falcon, for USAF, and the Sperry Sparrow, for the Navy.

- **Surface-to-air, for anti-aircraft defense.** Next step up in the size scale, these missiles are fired by the Army's Nike, now stationed around the United States in air defense, and soon to be sent to Europe. Missiles like this gen-



COUMBREL is one of the largest.

erally are powered by a liquid-propellant solid motor, although some later models may come with some solid engines and be capable of longer range. Intelligence may be self-contained, or it may be transmitted in the missile along a radio line which the missile slides like a tail rider the center of a ranging beam. A typical size (Nike) is 20 ft. long by six feet in diameter.

- **Anti-aircraft, for bombing missions.** These missiles are generally a body to which wings, powerplant and intelligence have been added. In use, they are carried internally or externally on a pilot's launcher to a point perhaps 100 miles from the ultimate target. The bomber then releases the missile, which flies on its own power to destruction at the target. In the interim, the rocket airplane has had time to get out of the target area. The small size and high speed of the missile make it a difficult target. Powerplant would almost certainly be a solid engine using liquid propellant. The intelligence would be self-contained. Size might be about 20 ft. long, with a 10 x 15 ft. wingspan and a body diameter of four or five feet. Outstanding example, at the time of the Bell Record, for USAF.

- **Surface-to-surface, for artillery support or bombing missions.** These are two-to-three miles in size. They have large wings, generally swept back, and a large engine. It can used guidance by radio, or it may require to be located by monitoring may be a sensitive one, as in the case of high speed, powered into an enemy, shell.

- **Guidance, which tells the missile where to go.** These are large, complex, expensive equipment, active, sensitive and precise. The words describe the type quite well. Generally, the other missiles (technically speaking) and the shorter range missiles are a pattern or at best, a semi-precision system. They are told what to do, and then do it. The long range and those with longer range generally have the inherent capacity to figure out what to do and then to execute the command.

Under the skin

Missiles have much in common, under their mobile hulls they all share the same basic components. Whether the job is to strike an enemy launcher five miles away or the enemy industrial heart 5,000 mi. away, these are the components that combine to do the job.

• **Warhead, which is the payload of the missile to be delivered on target.** This may be a 50-lb. explosive charge, a body armor bomb or a 14-inch. It may be a small cone, or a large sphere in a shaped charge. It can used guidance by radio, or it may require to be located by monitoring may be a sensitive one, as in the case of high speed, powered into an enemy, shell.

At the case time, it has grown from a scientific toy to an operational weapon, and from an expensive test vehicle to a reliable machine.

In future years, the higher now than at any time before.

and maintenance tracks, and transport and launch for the ground equipment, to cite three examples.

- **A missile does not have to come back from a mission.** This means that some components may be made with cost of replacement, then simply thrown away in production techniques, developed for high volume, low cost output. But it may also show up in a new engineering concept for an expendable engine or motor. By the same token, reliability must be increased, because a one-way mission has to be in secure use with a very high chance of missing the kill by a deliberate weapon, such as the Nike, this will probably be in the high to justify use of the missile in the first place.

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- **Powerplant, which makes the missile go.** Today's missiles are powered by conventional fuels, the same basic engine that propels airplanes, by rockets, the atmospheric and hydrogen-dynamic powerplants that depend on the reaction of gases to jets, gases and rockets, which carry along their own fuel and oxidizer in liquid or solid form and, along these the flow types of engines, can operate outside the earth's atmosphere.

- **Airframe, which holds all the other components.** This outside shell is a difficult design problem because of the extreme variety of loads imposed by flight, altitude, temperature, powerplant and in some cases, warheads. It may require a sophisticated design or a mysterious invention, it can be built of stainless steel, plastic, or aluminum alloy. It may be machined with great precision, or joined out with iron.

On the Ground

Supporting these missiles are the tools of ground equipment used to transport, assemble, check out, fuel and fire the weapons. These include an extensive variety of wheeled vehicles, mobile trailers, field trailers and trailer transporters, portable power supplies, partly mobile, mobile trailers, fuel trucks. One mobile system now entering service testing has no less than 57 different units, many on wheels, used to support field operations.

The missile has grown from the original concept of a cheap, expendable, simple one-shot gun to a complex weapon system that requires as much supporting effort as its own moment of action. Its cost has increased until some missile defenses only to fight out in such a sense as to appear at the ready.

At the case time, it has grown from a scientific toy to an operational weapon, and from an expensive test vehicle to a reliable machine.

In future years, the higher now than at any time before.



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Hydraulic Actuator Cylinder



Hydraulic Actuator Cylinder

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A New low voltage POWER SUPPLY

MODEL M-88
0-28 Volts D.C.
2.0 Amperes
1% Ripple
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Features

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- Zero line and load regulation
- Permanently adjusted control adjustments
- One control wiring terminal
- Compact, portable design
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REGULATION: 0.05% to 0.10% (0.05% to 0.10% at 1.0 A load, 100 Hz)

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Input—200 volts, 3 phase, 60 cycles
Output—25 volts DC, 100 amperes



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The aluminum cartridge-type terminal that most effectively terminates aluminum wire. Provides permanent insulation against moisture, salt and corrosion. Overcomes detrimental effect of electrolytic action and cold flow. No "hot" spots. Color coded for wire sizes 8 to 4/0.



Ampl-Bond terminal

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TERMINALS
AND
CONNECTORS

Provide completely insulated connections with full insulation support. Time-proven reliability in the Aircraft and Electronic Industries. Color coded for wire sizes 24 through 30.



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WIRE

CONNECTOR

Sealed conductor and shield simultaneously—assures secure, free connection. Accommodates multiple insulation diameters for both wire ranges, 22 to 18 and 16 to 14.



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Permit new freedom of design where space, weight, size and reliability are prime factors. Available for wire sizes 24 through 30.



A-MP AUTOMATIC MACHINES

A-MP Auto Machines bring production line speed to terminal application. The shielded taper pin produces up to 1000 quality secured terminations per hour.



Look for the release of A-MP's new STRATO TAPER Terminal. It's a completely new design for wire 4/0 through up to 50,000 feet and is approximately 100 times faster than any other.

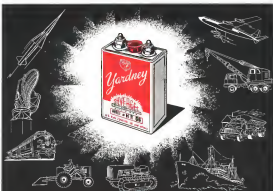
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AMP



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- FLAT VOLTAGE CHARACTERISTIC**—no discharge dip at very rated down to end of capacity.
- HIGH SAFETY FACTOR**—Springs and linkage means eliminated on battery during storage and discharge cycle.
- MECHANICAL STRENGTH**—High resistance to shock, vibration, rapid acceleration and deceleration.
- WIDE TEMPERATURE RANGE**—Efficient at 140°F. and as low as -65°F.

Table of Yardney High-Power Models

Yardney Model	Rated Capacity (Amp-hrs)	Weight (lb.)	Dimensions (in.)	Notes
40-10	10.0	2.0	3.0 x 1.5 x 1.5	Automotive
40-15	15.0	3.0	3.0 x 1.5 x 1.5	Automotive
40-20	20.0	4.0	3.0 x 1.5 x 1.5	Automotive
40-30	30.0	6.0	3.0 x 1.5 x 1.5	Automotive
40-40	40.0	8.0	3.0 x 1.5 x 1.5	Automotive
40-50	50.0	10.0	3.0 x 1.5 x 1.5	Automotive
40-60	60.0	12.0	3.0 x 1.5 x 1.5	Automotive
40-70	70.0	14.0	3.0 x 1.5 x 1.5	Automotive
40-80	80.0	16.0	3.0 x 1.5 x 1.5	Automotive
40-90	90.0	18.0	3.0 x 1.5 x 1.5	Automotive
40-100	100.0	20.0	3.0 x 1.5 x 1.5	Automotive
40-120	120.0	24.0	3.0 x 1.5 x 1.5	Automotive
40-150	150.0	30.0	3.0 x 1.5 x 1.5	Automotive
40-200	200.0	40.0	3.0 x 1.5 x 1.5	Automotive
40-300	300.0	60.0	3.0 x 1.5 x 1.5	Automotive
40-400	400.0	80.0	3.0 x 1.5 x 1.5	Automotive
40-500	500.0	100.0	3.0 x 1.5 x 1.5	Automotive
40-600	600.0	120.0	3.0 x 1.5 x 1.5	Automotive
40-700	700.0	140.0	3.0 x 1.5 x 1.5	Automotive
40-800	800.0	160.0	3.0 x 1.5 x 1.5	Automotive
40-900	900.0	180.0	3.0 x 1.5 x 1.5	Automotive
40-1000	1000.0	200.0	3.0 x 1.5 x 1.5	Automotive
40-1200	1200.0	240.0	3.0 x 1.5 x 1.5	Automotive
40-1500	1500.0	300.0	3.0 x 1.5 x 1.5	Automotive
40-2000	2000.0	400.0	3.0 x 1.5 x 1.5	Automotive
40-3000	3000.0	600.0	3.0 x 1.5 x 1.5	Automotive
40-4000	4000.0	800.0	3.0 x 1.5 x 1.5	Automotive
40-5000	5000.0	1000.0	3.0 x 1.5 x 1.5	Automotive
40-6000	6000.0	1200.0	3.0 x 1.5 x 1.5	Automotive
40-7000	7000.0	1400.0	3.0 x 1.5 x 1.5	Automotive
40-8000	8000.0	1600.0	3.0 x 1.5 x 1.5	Automotive
40-9000	9000.0	1800.0	3.0 x 1.5 x 1.5	Automotive
40-10000	10000.0	2000.0	3.0 x 1.5 x 1.5	Automotive
40-12000	12000.0	2400.0	3.0 x 1.5 x 1.5	Automotive
40-15000	15000.0	3000.0	3.0 x 1.5 x 1.5	Automotive
40-20000	20000.0	4000.0	3.0 x 1.5 x 1.5	Automotive
40-30000	30000.0	6000.0	3.0 x 1.5 x 1.5	Automotive
40-40000	40000.0	8000.0	3.0 x 1.5 x 1.5	Automotive
40-50000	50000.0	10000.0	3.0 x 1.5 x 1.5	Automotive
40-60000	60000.0	12000.0	3.0 x 1.5 x 1.5	Automotive
40-70000	70000.0	14000.0	3.0 x 1.5 x 1.5	Automotive
40-80000	80000.0	16000.0	3.0 x 1.5 x 1.5	Automotive
40-90000	90000.0	18000.0	3.0 x 1.5 x 1.5	Automotive
40-100000	100000.0	20000.0	3.0 x 1.5 x 1.5	Automotive
40-120000	120000.0	24000.0	3.0 x 1.5 x 1.5	Automotive
40-150000	150000.0	30000.0	3.0 x 1.5 x 1.5	Automotive
40-200000	200000.0	40000.0	3.0 x 1.5 x 1.5	Automotive
40-300000	300000.0	60000.0	3.0 x 1.5 x 1.5	Automotive
40-400000	400000.0	80000.0	3.0 x 1.5 x 1.5	Automotive
40-500000	500000.0	100000.0	3.0 x 1.5 x 1.5	Automotive
40-600000	600000.0	120000.0	3.0 x 1.5 x 1.5	Automotive
40-700000	700000.0	140000.0	3.0 x 1.5 x 1.5	Automotive
40-800000	800000.0	160000.0	3.0 x 1.5 x 1.5	Automotive
40-900000	900000.0	180000.0	3.0 x 1.5 x 1.5	Automotive
40-1000000	1000000.0	200000.0	3.0 x 1.5 x 1.5	Automotive
40-1200000	1200000.0	240000.0	3.0 x 1.5 x 1.5	Automotive
40-1500000	1500000.0	300000.0	3.0 x 1.5 x 1.5	Automotive
40-2000000	2000000.0	400000.0	3.0 x 1.5 x 1.5	Automotive
40-3000000	3000000.0	600000.0	3.0 x 1.5 x 1.5	Automotive
40-4000000	4000000.0	800000.0	3.0 x 1.5 x 1.5	Automotive
40-5000000	5000000.0	1000000.0	3.0 x 1.5 x 1.5	Automotive
40-6000000	6000000.0	1200000.0	3.0 x 1.5 x 1.5	Automotive
40-7000000	7000000.0	1400000.0	3.0 x 1.5 x 1.5	Automotive
40-8000000	8000000.0	1600000.0	3.0 x 1.5 x 1.5	Automotive
40-9000000	9000000.0	1800000.0	3.0 x 1.5 x 1.5	Automotive
40-10000000	10000000.0	2000000.0	3.0 x 1.5 x 1.5	Automotive
40-12000000	12000000.0	2400000.0	3.0 x 1.5 x 1.5	Automotive
40-15000000	15000000.0	3000000.0	3.0 x 1.5 x 1.5	Automotive
40-20000000	20000000.0	4000000.0	3.0 x 1.5 x 1.5	Automotive
40-30000000	30000000.0	6000000.0	3.0 x 1.5 x 1.5	Automotive
40-40000000	40000000.0	8000000.0	3.0 x 1.5 x 1.5	Automotive
40-50000000	50000000.0	10000000.0	3.0 x 1.5 x 1.5	Automotive
40-60000000	60000000.0	12000000.0	3.0 x 1.5 x 1.5	Automotive
40-70000000	70000000.0	14000000.0	3.0 x 1.5 x 1.5	Automotive
40-80000000	80000000.0	16000000.0	3.0 x 1.5 x 1.5	Automotive
40-90000000	90000000.0	18000000.0	3.0 x 1.5 x 1.5	Automotive
40-100000000	100000000.0	20000000.0	3.0 x 1.5 x 1.5	Automotive
40-120000000	120000000.0	24000000.0	3.0 x 1.5 x 1.5	Automotive
40-150000000	150000000.0	30000000.0	3.0 x 1.5 x 1.5	Automotive
40-200000000	200000000.0	40000000.0	3.0 x 1.5 x 1.5	Automotive
40-300000000	300000000.0	60000000.0	3.0 x 1.5 x 1.5	Automotive
40-400000000	400000000.0	80000000.0	3.0 x 1.5 x 1.5	Automotive
40-500000000	500000000.0	100000000.0	3.0 x 1.5 x 1.5	Automotive
40-600000000	600000000.0	120000000.0	3.0 x 1.5 x 1.5	Automotive
40-700000000	700000000.0	140000000.0	3.0 x 1.5 x 1.5	Automotive
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40-900000000	900000000.0	180000000.0	3.0 x 1.5 x 1.5	Automotive
40-1000000000	1000000000.0	200000000.0	3.0 x 1.5 x 1.5	Automotive
40-1200000000	1200000000.0	240000000.0	3.0 x 1.5 x 1.5	Automotive
40-1500000000	1500000000.0	300000000.0	3.0 x 1.5 x 1.5	Automotive
40-2000000000	2000000000.0	400000000.0	3.0 x 1.5 x 1.5	Automotive
40-3000000000	3000000000.0	600000000.0	3.0 x 1.5 x 1.5	Automotive
40-4000000000	4000000000.0	800000000.0	3.0 x 1.5 x 1.5	Automotive
40-5000000000	5000000000.0	1000000000.0	3.0 x 1.5 x 1.5	Automotive
40-6000000000	6000000000.0	1200000000.0	3.0 x 1.5 x 1.5	Automotive
40-7000000000	7000000000.0	1400000000.0	3.0 x 1.5 x 1.5	Automotive
40-8000000000	8000000000.0	1600000000.0	3.0 x 1.5 x 1.5	Automotive
40-9000000000	9000000000.0	1800000000.0	3.0 x 1.5 x 1.5	Automotive
40-10000000000	10000000000.0	2000000000.0	3.0 x 1.5 x 1.5	Automotive
40-12000000000	12000000000.0	2400000000.0	3.0 x 1.5 x 1.5	Automotive
40-15000000000	15000000000.0	3000000000.0	3.0 x 1.5 x 1.5	Automotive
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40-500000000000	500000000000.0	100000000000.0	3.0 x 1.5 x 1.5	Automotive
40-600000000000	600000000000.0	120000000000.0	3.0 x 1.5 x 1.5	Automotive
40-700000000000	700000000000.0	140000000000.0	3.0 x 1.5 x 1.5	Automotive
40-800000000000	800000000000.0	160000000000.0	3.0 x 1.5 x 1.5	Automotive
40-900000000000	900000000000.0	180000000000.0	3.0 x 1.5 x 1.5	Automotive
40-1000000000000	1000000000000.0	200000000000.0	3.0 x 1.5 x 1.5	Automotive
40-1200000000000	1200000000000.0	240000000000.0	3.0 x 1.5 x 1.5	Automotive
40-1500000000000	1500000000000.0	300000000000.0	3.0 x 1.5 x 1.5	Automotive
40-2000000000000	2000000000000.0	400000000000.0	3.0 x 1.5 x 1.5	Automotive
40-3000000000000	3000000000000.0	600000000000.0	3.0 x 1.5 x 1.5	Automotive
40-4000000000000	4000000000000.0	800000000000.0	3.0 x 1.5 x 1.5	Automotive
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40-6000000000000	6000000000000.0	1200000000000.0	3.0 x 1.5 x 1.5	Automotive
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40-15000000000000	15000000000000.0	3000000000000.0	3.0 x 1.5 x 1.5	Automotive
40-20000000000000	20000000000000.0	4000000000000.0	3.0 x 1.5 x 1.5	Automotive
40-30000000000000	30000000000000.0	6000000000000.0	3.0 x 1.5 x 1.5	Automotive
40-40000000000000	40000000000000.0	8000000000000.0	3.0 x 1.5 x 1.5	Automotive
40-50000000000000	50000000000000.0	10000000000000.0	3.0 x 1.5 x 1.5	Automotive
40-60000000000000	60000000000000.0	12000000000000.0	3.0 x 1.5 x 1.5	Automotive
40-70000000000000	70000000000000.0	14000000000000.0	3.0 x 1.5 x 1.5	Automotive
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40-90000000000000	90000000000000.0	18000000000000.0	3.0 x 1.5 x 1.5	Automotive
40-100000000000000	100000000000000.0	20000000000000.0	3.0 x 1.5 x 1.5	Automotive
40-120000000000000	120000000000000.0	24000000000000.0	3.0 x 1.5 x 1.5	Automotive
40-150000000000000	150000000000000.0	30000000000000.0	3.0 x 1.5 x 1.5	Automotive
40-200000000000000	200000000000000.0	40000000000000.0	3.0 x 1.5 x 1.5	Automotive
40-300000000000000	300000000000000.0	60000000000000.0	3.0 x 1.5 x 1.5	Automotive
40-400000000000000	400000000000000.0	80000000000000.0	3.0 x 1.5 x 1.5	Automotive
40-500000000000000	500000000000000.0	100000000000000.0	3.0 x 1.5 x 1.5	Automotive
40-600000000000000	600000000000000.0	120000000000000.0	3.0 x 1.5 x 1.5	Automotive
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40-800000000000000	800000000000000.0	160000000000000.0	3.0 x 1.5 x 1.5	Automotive
40-9000000000				



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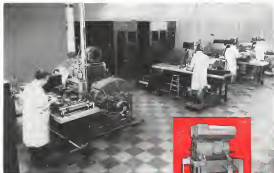
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Study indicated 4 months to 1 year, was at least 10% with the body, 60% within 10 to 20 min. Complete range of ages, symptoms and other data, etc.

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- *b. Linearity—0.7%
- *c. Turbidity—20"
- *d. Readiness—3000 ohms
- *e. Resistance—3 Volts D.C.
- f. Dead Space—2" Maximum

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ASK FOR CATALOG 223-A



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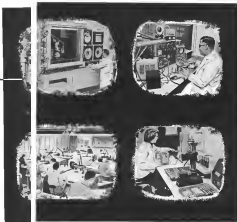
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- A... Jet Engine Pressure Ratio Systems.** Used for low weight, small size, accuracy, stability, sensitivity. Refer to Bulletin #351.
- B... Digital Counter.** Possible rate of 75,000 counts per minute, an instantaneous output of 15 binary digits in decimal binary code. Refer to Bulletin #352.
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- D... Synthesizers, Servo Motors and Resolvers.** Specifications and characteristics of over 130 units and types are given in Bulletin #353.
- E... Fuel Flow Transmitters.** Major instruments, components, and systems for aircraft are available. Write for specific data.
- F... Gear Trains.** Conventional and at moment types for use with servo motors and systems.
- G... Potentiometers.** Linear and non-linear, one turn potentiometers, single turn continuous wave and others are described in Bulletin #354.
- H... Airspeed/Static Pressure Probes.** Pressure, velocity and compound for the pitot-static, dynamic, and total static field. AN type for aircraft. Refer to Bulletin #355.

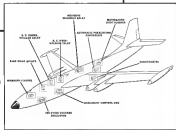


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HAYDON TIMING MOTORS



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4000



3100

HEAVY DUTY, SLOW SPEED
The 3100 Series motor meets all the basic HAYDON motor and a heavy-duty gear train in a steel housing. Designed for applications requiring higher torques at slow speeds, this unit is particularly suitable for clock drives in a recording and control instruments. Standard speeds from 8 hours to 14 days per revolution.

D-C, REVERSIBLE
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2500
12000

ALL HAYDON TIMING MOTORS
are totally enclosed and can be operated in any position. Write for Free "Haydon Electric Timing Motors" catalog.



4000

400 CYCLE HYSTERESIS-TYPE
The 4000 Series 400 cycle timing motor is an hysteresis type synchronous timing motor, available in two sizes. It is furnished with operation for self-starting operation in single phase. Features of low-pollution, voltage and heat do not affect timing, which is as accurate as the frequency control.

HAYDON CLOCK MOVEMENTS



1000

ROUND MOVEMENT
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RECTANGULAR MOVEMENT
Features completely enclosed construction and easy installation. Back or bottom set, setting or control mounting, choice of remote motor groups and sizes.



1000

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HAYDON TIMING DEVICES



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400 CYCLE ELAPSED TIME INDICATOR
The 1000 Series Elapsed Time Indicator is designed specifically for 400 cycle operation in an approximate 1/2" diameter. Face diameter is 1.561", length 2.610", weight 8 gm. These instruments have three 2 mils and 3 mils in width of face of hours up to 10,000 and display.

40 CYCLE ELAPSED TIME INDICATORS
The 2000 Series Elapsed Time Indicator provides simple, compact and accurate measuring of elapsed time for 40 cycle operation. They are designed for use as temperature compensator for equipment requiring rapid of heat cycling and display.



2000



2100

HERMETICALLY SEALED TIME DELAY RELAYS
The 2000 Series Time Delay Relay is an hermetically sealed timer for industrial applications. It can be supplied for 60 or 400 cycle A.C. or D.C. The use of a relay coil for switching operations improves a minimum load on the motor which is engaged in its test function as a time standard.

ADJUSTABLE TIME DELAY RELAYS
The 3000 Series Time Delay Relay provides time delay as interval timing in various ranges up to 30 minutes. Such applications as the protection of power lines, or timing problems of a complete cycle of operation.



3000



2000

FIXED INTERVAL REPEAT CYCLE TIMERS
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3000

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Type 9 motor-driven induction generator driving two Type 10CT synchros through gear train having ratio of 100:1. One synchro controls control transformer to operate which second synchro transducer bandwidth referenced by range. Center disc two synchros during specified degrees of synchro rotation.



Equipment to indicate phase angle difference between two line frequency signals received over radio links. One channel is a 400 cps resolver supply for two indicators which channel condition modulates matching and a series signal for any indicator. Complete system includes an oscillator (two indicators, and two amplifiers).

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problems
like
yours**

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3 REASONS WHY IT'S for Aircraft and



IN CHARGE OF SYSTEMS DEVELOPMENT at General Mills are Dr. Carl E. Kubes (left) who was a top man on German radar and V2 intelligence and also spent five years at Wright Air Development Center; and Dr. Howard H. Butler (right) who came to General Mills via Col. Tash, Raytheon, Fordham Guided Missile Division and W. L. Mason Corp. Looking on is Dr. Claude Tronstad, director of Engineering Research and Development, a national figure in electronics because of his work for the National Bureau of Standards, Stanford Research, General Mills, and the Department of Defense.

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AMONG THE SPECIALIZED EQUIPMENT in our plants are ultra-precision gear hobbing machines, 100 engine test cells (shown having head and casing for the Y-4 boardlight); modern equipment for precision assembly and inspection.



General Mills Missile Systems...



COORDINATE
CONVERTER



Y-4 BOARDLIGHT



FLIGHT RECORDER



AUTOPAC READER

HERE ARE SOME EXAMPLES of the precision electro-mechanical engineering and close tolerance production services available to you at General Mills. The Y-4 Boardlight protects against buckling from Submarine Depth; the Coordinate Converter links the

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Year	State	Agency	Population	Mileage of Highways	Mileage of Interstates	Average Daily Traffic Volume	Average Vehicle		Average Annual Mileage
							Make	Model	
1990	CA	Caltrans	23,000,000	1,000	1,000	100	1990	1990	10,000
1991	CA	Caltrans	23,500,000	1,000	1,000	100	1991	1991	10,000
1992	CA	Caltrans	24,000,000	1,000	1,000	100	1992	1992	10,000
1993	CA	Caltrans	24,500,000	1,000	1,000	100	1993	1993	10,000
1994	CA	Caltrans	25,000,000	1,000	1,000	100	1994	1994	10,000
1995	CA	Caltrans	25,500,000	1,000	1,000	100	1995	1995	10,000
1996	CA	Caltrans	26,000,000	1,000	1,000	100	1996	1996	10,000
1997	CA	Caltrans	26,500,000	1,000	1,000	100	1997	1997	10,000
1998	CA	Caltrans	27,000,000	1,000	1,000	100	1998	1998	10,000
1999	CA	Caltrans	27,500,000	1,000	1,000	100	1999	1999	10,000
2000	CA	Caltrans	28,000,000	1,000	1,000	100	2000	2000	10,000
2001	CA	Caltrans	28,500,000	1,000	1,000	100	2001	2001	10,000
2002	CA	Caltrans	29,000,000	1,000	1,000	100	2002	2002	10,000
2003	CA	Caltrans	29,500,000	1,000	1,000	100	2003	2003	10,000
2004	CA	Caltrans	30,000,000	1,000	1,000	100	2004	2004	10,000
2005	CA	Caltrans	30,500,000	1,000	1,000	100	2005	2005	10,000
2006	CA	Caltrans	31,000,000	1,000	1,000	100	2006	2006	10,000
2007	CA	Caltrans	31,500,000	1,000	1,000	100	2007	2007	10,000
2008	CA	Caltrans	32,000,000	1,000	1,000	100	2008	2008	10,000
2009	CA	Caltrans	32,500,000	1,000	1,000	100	2009	2009	10,000
2010	CA	Caltrans	33,000,000	1,000	1,000	100	2010	2010	10,000
2011	CA	Caltrans	33,500,000	1,000	1,000	100	2011	2011	10,000
2012	CA	Caltrans	34,000,000	1,000	1,000	100	2012	2012	10,000
2013	CA	Caltrans	34,500,000	1,000	1,000	100	2013	2013	10,000
2014	CA	Caltrans	35,000,000	1,000	1,000	100	2014	2014	10,000
2015	CA	Caltrans	35,500,000	1,000	1,000	100	2015	2015	10,000
2016	CA	Caltrans	36,000,000	1,000	1,000	100	2016	2016	10,000
2017	CA	Caltrans	36,500,000	1,000	1,000	100	2017	2017	10,000
2018	CA	Caltrans	37,000,000	1,000	1,000	100	2018	2018	10,000
2019	CA	Caltrans	37,500,000	1,000	1,000	100	2019	2019	10,000
2020	CA	Caltrans	38,000,000	1,000	1,000	100	2020	2020	10,000

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**INSTRUMENTS
CONTROLS**



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A continued expansion of Raytheon's Missile Systems Division has created long range opportunities for experienced engineers. The Missile Systems Division is located in a modern laboratory 20 miles from Boston in a country setting and offers a choice of jobs or security living facilities, recreational facilities and proximity to the educational, cultural and entertainment centers of Boston.

Raytheon has engineer grade contracts in the guided missile field including contracts involving missile responsibility for system design including air frame guidance design and solid fuel systems. The Division is engaged in all phases of missile development from study programs through design, flight testing and production. One missile system department is engaged in the fulfillment of contracts for complete guided missile systems including propulsion systems, weapons control systems and electronic flight and landing control systems. These programs entail development of accurate new test means such as IMACV and pulse display sets.

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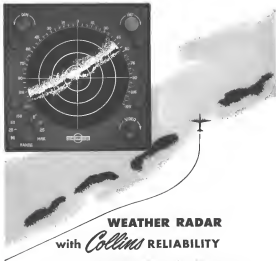


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Sperry has been a pioneer in aviation since 1912. In that year Lawrence Sperry made the first automatic flight, turning his hydrocycloplane over to the first Sperry Stabilizer. This was the beginning of automatic flight controls. In 1918 working with the U. S. Navy, Lawrence Sperry again pioneered in developing the first aerial torpedo whose course could be pre-set and held during prolonged flight with Sperry instruments. This was in actuality the first guided missile. In 1923, Lieutenant "Jimmy" Doolittle flew under a hooded cockpit, guided by the Sperry Gyro-Horizon and Directional Gyro. This was the first complete "blind" flight. In 1937, an Air Corps crew landed their Fokker aircraft using the Sperry Automatic Pilot and radio as guidance. This was the first complete automatic landing.

When the above events took place, these developments were advanced for their time. They were solutions to future problems. Other outstanding "Sperry firsts" are represented by such famous names as Zero Radar*, Flight Director, Gyrosum* Compass, Engine Analyzer and the Electronic Gyrocompass.* This pioneering in advanced instruments and controls has been a continuing program for Sperry . . . a program of anticipating the needs of tomorrow's aircraft . . . of anticipating the needs of the military in helping to discourage possible aggressors.

Today Sperry's pioneering continues in the design, development and production of aviation instruments, controls and systems. To maintain its traditional leadership in aviation, a new Avionics Equipment Division has been recently organized to assure operators efficiency in meeting future aviation requirements. Additionally, the needs of the Army, Navy and Air Force for special military systems are met through our headquarters' organization. And a new Special Missile Systems Division coordinates major Sperry activities in this expanding field. How extensively Sperry is engaged in aviation is indicated by the many specific fields of endeavor described briefly in the following pages.

FLIGHT CONTROL SYSTEMS

The latest in gyroscopes, servo and signal systems, techniques have been incorporated in Flight Control Systems to give precise, automatic control of flight aircraft. Various experimental models of Sperry automatic pilots are in constant use on the world's leading airlines and on hundreds of business aircraft. Used in conjunction with the Sperry Radio Beam Coupler, the automatic pilot keeps the plane on the radio beam accurately. In landing, the Radio Beam Coupler automatically

responds to the localizer and landing beam for complete automatic approaches.

Military models of Flight Control Systems include automatic pilots for bombers, fighters, transports, helicopters, drones and missiles. Tied in with the latest bombing navigation systems, the automatic pilot flies the bomber during the last crucial moments of the bombing run. For helicopters a flight control system gives precise automatic stabilization and control even under the most exacting conditions of hovering.

New systems today incorporate the Sperry Integrated Instrument System to give the pilot display information from common gyro and power supplies. Other developments in Flight Control Systems are hydraulic power controls, yaw and pitch dampers and G-Simulator systems.



FLIGHT INSTRUMENTS

More flight data, in clearer visual form, in less space, is the modern cockpit need answered by the Sperry Integrated Instrument System. This System consists of a remote acoustic and reliable primary direction instrument, a combined Zero Reader flight director and gyro-horizon, and a pedestal deviation indicator. These three new instruments are incorporated into the basic cockpit instruments now in common use, giving the pilot more of the data he needs without increasing the number of instruments on his panel. This System also is integrated with Flight Control Systems so that the same gages and power supplies can be used for automatic as well as manual flying. Other Integrated Instrument Systems are in development which combine engine instruments and fire control systems with flight instruments and control systems.

In direction instruments, Sperry has many models of Gyrocompass, Directional Gyro and Heading indicators to provide accurate heading information. In attitude instruments, Sperry has a variety of Gyro-Horizons, Roll and Pitch Indicators, Stable Platforms and Compensated Vertical References to provide accurate attitude information. Specific instruments for helicopters include a Flight Director for ease of manual control and an engine rpm control.

In navigation systems, Sperry developments include a true-North Gyro-Compass, Stable Platform for pitch, roll and heading, an Inertial Navigation System and a Doppler Inertial Navigation System.



ENGINE ANALYZERS

On the world's leading airlines and many US military aircraft, Sperry Engine Analyzers keep a constant check on every part of a plane's ignition system. Look inside each cylinder and there's the exact performance of every spark plug. Before take-off, the system enables quick "burn-in" to assure smooth, maximum power. In the air, the flight engineer, watching the readings on his analyzer scope, can detect malfunctions in the engine's performance which can be quickly corrected by adjustments or replacements immediately upon landing. Another important function of the Engine Analyzer is providing vibration analysis. Valve clearance trouble with its resulting fuel and power waste is easily detected. Portable Engine Analyzers are widely used in ground maintenance and engine test cells.

SPERRY ENGINE ANALYZER
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Engine Analyzers, including vibration analysis, have now been developed for turboprop and turboprop engines. In addition to fixed-wing aircraft, Engine Analyzers are applicable to helicopters.

TURBINE CONTROLS

With the increasing speed of aircraft, it has become more and more important to integrate power plant controls with the airplane and its mission. Sperry is actively engaged in developing control instruments and systems for turboprop, turbopump and rocket engines. New developments, in addition to an Engine Analyzer which includes vibration analysis, are a Thrust Indicator, Temperature Indicator and Fire Detector.



BOMBING NAVIGATION SYSTEMS

The K Bombing System developed for the Air Force by Sperry combines automatic navigation with all-weather identification and bombing of any target. Once in the target area the Navigator Bombardier Observer locates the target visually, or by radar. With the Observer keeping cross-hairs directly over the target, the K System takes over and automatically navigates, flies the bomber, compensates for speed, altitude and wind, and releases the bomb at the instant required to insure a direct hit. Advanced types of bombing-navigation systems to meet critical mission requirements of future aircraft are currently under development.

AIRCRAFT FIRE CONTROL SYSTEMS

In this field, advanced projects of a divided nature include the design and development of systems to meet the tactical and strategic requirements of new bombers, fighter-bombers, and intercepter aircraft. New techniques in integrating flight control, computer and radar functions of fire control systems are rendering obsolete the competing paralytic of today.

DRONE SYSTEMS

Unmanned jet drones are currently being flown routinely with precision by USAF specialists from ground-based



control stations or airborne director aircraft. Equipped with Sperry Remote Flight Control Systems, the drones respond to "boom" box commands in special missions such as weapon systems' evaluation. Under radio command the drones are fully maneuverable and recoverable and in some cases have penetrated a blast area with split-second accuracy. Advanced drone systems are currently under development.

GUIDED MISSILES

Navy's Sparrow I is the first air-to-air guided missile produced in volume for operational use. Designed by Sperry for the Bureau of Aeronautics, Sparrow I is rocket-powered, radar-guided and light and compact enough so that multiple units can be carried by fighter-type jets. It is deadly accurate and capable of outmaneuvering the swiftest combat aircraft.

In addition to the Sparrow I, Sperry also supplies the stabilizable system for Navy's Regulus, Chance Vought's surface-to-surface missile. Keeping Regulus on its course with a view-like gage, the Sperry system is sensitive to the slightest signal change in flight path, makes instant corrections and then Regulus—undisturbed through intricate maneuvers—is at its target and altitude.



Sperry is also engaged in five other classified missile programs in supplying guidance, stabilization and control systems.

RADARS

Working in both pulse and continuous wave, Sperry has radars in all important frequencies for a wide range of applications. Among radar functions provided in recent developments are fire control tracking, airborne beacon, navigational search, air-to-air, medium-range, airborne range for measurement of distance to target, and long-range navigation by ground-based radar.

In addition to an extensive radar program, Sperry is also engaged in the development and production of Electronic Counter Measures.

KLYSTRONS AND TRAVELING WAVE TUBES

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The Klystron tube, a Sperry development, is the heart of microwave radar. Airborne radar employs Klystrons for mapping, fire control, alarm warning, and for navigation and bombing. In guided missiles the Klystron makes possible more accurate control permits guidance over longer paths. In air navigation and traffic control systems, Klystrons amplify stable radio signals to the power required for the range of the system.



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FLIGHT RESEARCH

A specialized fleet of company-owned aircraft including a helicopter is based at the company's flight research center. Each of these planes is a "flying laboratory" for testing and evaluating Sperry instrumentation. A wide variety of military aircraft ranging from jet fighters to heavy bombers is assigned to the flight research center to aid in carrying out various development contracts.

RESEARCH AND ADVANCED DEVELOPMENTS

In an ever-continuing search to anticipate the needs of the future in aviation, Sperry is constantly at work on components and systems to solve the problems of tomorrow. Meanwhile a long-range research program is underway to explore new scientific horizons to speed aviation's progress.



SPERRY SERVICE

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(above) Sperry Gyroscope Company's main plant and headquarters at Great Neck, New York

(below) Sperry Flight Research Center, MacArthur Field, Long Island, New York



(above) Sperry Paragon Company, Bristol, Tennessee, is devoted to the production of Sperry I servos.

(below) Sperry Electronic Tube Division, Gainesville, Florida, is producing Klystrons in large quantities.



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Support Items Determine Weapon Value

The airplane is no longer the dominant component in the development and production of an aerial weapon system.

There is a complete reversal of the traditional concept where the actual airplane was the major and most of any manufacturer's program. Now it is one typical aircraft system, 45 items of support equipment go into squadron service with the missile.

Design and production responsibility for those 45 items has been placed squarely in the lap of the prime contractor on the weapon system.

The introduction of the airplane into the supporting equipment has created a host of new problems. Greatest impact on the aircraft industry has been the need for a number of new parts contracts for non-aerial items, which have added weight to be taken into account in the airplane to meet manufacturing tolerances. This means of this country's top plane builders have found themselves working for a electronics firm, an automobile mass manufacturer or a university.

Another major impact has been the substitution of the aircraft manufacturer that when he took on a weapons system, he took on the production of training, technical manuals and transportation. "We started to build missiles, and wound up in the trailer business," was the complaint of one aircraft executive.

He made the comment while looking over an assembly floor along which 100 missiles in two parallel production lines had just moved a series of fixtures holding the highly polished missile air frames. Down the other end as an attendant of two and four missiles loaded the missiles against the field test kits, missile maintenance vans, ground control and firing centers and special transport trailers.

Each one of these three was a specific part of an overall system, and each was necessary to the successful operation of the missile.

Missiles Are Typical

Follow a typical missile from the time it is delivered to an operational unit until it is launched toward the target.

It is offloaded from train, plane or boat and transported by road to an assembly and inspection area. There, the missile is placed in a ready shot beam. Specific missions may require specific adjustments of the equipment.

Final testing and attachment of the weapon are done in a separate area. The launching vehicle is transport truck.

After the weapon is in the field, there is another launching problem: How is it to be cycled through the usual field level and depot level maintenance routine? Under recent USAF plans, specialized joint depot have specific overhaul responsibilities assigned to one, two, or even three, centers of the USAF.

Under the best interpretation of the support system concept, this is not a weapons problem. Repair and maintenance should be done under one roof. At least one system contractor is now studying the most practical of organizing and operating a missile support depot for the USAF.

Continues of the support supply chain, has also forced a second look at logistic support of field weapons systems. Such studies also deal with the local framework of the system concept and active staff, of the problem is more than a missile.

More Than a Missile

The executive who led the initial building studies and wound up with broken arms, is now, understanding the case.

He could also wind up before he is down-operating a missile and more complex system, running a graduate school in weapons and systems, or entering a technical school in maintenance, applying an audit for test personnel and utility model parts between the factory and the test center, publishing technical manuals, and so on, and so on.

Then the weapon he develops and produces in reach one part of the entire system task. The halfhearted specialist missile units that go along into battle to support one airplane or one missile, have given rise to discussions to the manifold problems of production.

The problems associated with the production of guided missile systems are typical for any weapon. An inter-continental bomber or transport aircraft, or even a rifle, is no exception. It is only a part of an integrated unit which must be designed and built to an integrated unit.

But looking even deeper into the supporting equipment of weapons systems, one finds the importance of even the smallest parts. The fact that the factory of the only source of turbine blade stress production of even jet engines and the airplane that power.

Knowledge of the interdependence of every item in the weapon system is the key to successful development.

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 Huber Tool Co., 1212 S. 10th St., Fargo 1, N.D.
 IMPVUL NEAL GUNNERS 1987, 11 Hudson St., Boston 10, N.Y.
 Special Products, Inc., General Manufacturing Co., 400 S. 1st St., Milwaukee 1, Wis.
 Chicago Precision Tool Co., 4001 W. 14th St., New York 25, N.Y.
 Rose Metal Products Company, 2441 North Wilson Ave., Chicago 16, Ill.
 Sank Special Tooling, Windsor Locks, Conn.

Seam, P. O. Box 885, Lee Valley, Ont.
 Omega Tool & Co., North Water St., Imperial Steel Co., 11 Broadway, New York, N.Y.
 de Loo Tool, Inc., 8045 5th St., South Gate 1, Calif.
 O'Brien Tool Company, 124 South Street, Westfield, Conn.
 Crown Wire Co., 1221 West 10th Street, Lincoln 1, Neb.
 Tools Etc., New Britain Road Co., Box 10, South St., New Britain, Conn.
 American Tool Co., 140 North 10th St., Oklahoma, Okla.
 Power Tool, 2009 Santa Fe Ave., Los Angeles 14, Calif.
 Williams, Inc., 100 South 10th Ave., Morrisville, Calif.
 British Tool Co., 1075 Reading St., Jackson, Miss.
 South-West Tool Co., 1700 10th Ave., Kansas, 66104
 Ohio Steel Forge & Tool Co., Lima 1, N.Y.
 J. H. Williams & Co., 101 West 10th, Buffalo 1, N.Y.

Yokes, Cable & Wire

All American Aircraft Parts, Inc., 1301 West Pacific Coast Highway, Redondo Beach, Calif.
 American Co., Inc., 1214 East 10th Ave., Tulsa 1, Okla.
 P. M. Drake Inc., General Instrument Div., 101 First St., Chicago 10, Ill.
 Ketchikan Manufacturing Co., 100-40 Grand St., Brooklyn 1, N.Y.
 SOUTHERN BRIDGE, INC., 1001 St. Piquette Street, Los Angeles 1, California
 Tulsa Tools & Machine Co., 1000 Bristol Ave., Tulsa 10, N.Y.

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Adv. The Precision Metals Co., American Steel & Rolling Co., Ltd. Building, New York, N.Y.

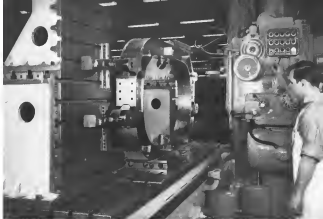
Admet Shaping & Rolling Works Inc., 200 Belmont Ave., Brooklyn 1, N.Y.
 Capital Steel Co., American Steel, Chicago 1, Ill.
 O'Brien Shaping Co., New Jersey 2nd St., 101 1st St., New York 20, N.Y.
 Republic Steel Corp., 100 1st St., Buffalo 1, N.Y.
 Henry Steel, Inc., 1010 10th Ave., Brooklyn 1, N.Y.
 Republic Steel Corp., 1000 10th Ave., Buffalo 1, N.Y.

Zipers

The B. J. Graham Co., 100 South Main St., Akron 10, Ohio
 Craft Systems, 120 Broadway, New York, N.Y.
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for RECORDING, REPRODUCING and ANALYZING EQUIPMENT

STANDARD HEADS

Mag. Head	Head	Wav. C. to C.	1/4"	1/2"	3/4"	1"	1 1/4"	1 1/2"	1 3/4"	2"
100A-00001	100	1.40	20	10	6	4	3	2	1	1
100B-00001	200	1.40	20	10	6	4	3	2	1	1
100C-00001	400	1.40	20	10	6	4	3	2	1	1
100D-00001	800	1.40	20	10	6	4	3	2	1	1
100E-00001	1600	1.40	20	10	6	4	3	2	1	1
100F-00001	3200	1.40	20	10	6	4	3	2	1	1
100G-00001	6400	1.40	20	10	6	4	3	2	1	1
100H-00001	12800	1.40	20	10	6	4	3	2	1	1
100I-00001	25600	1.40	20	10	6	4	3	2	1	1

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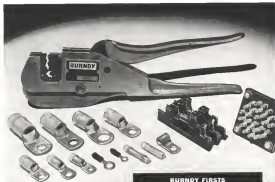
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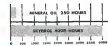
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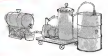
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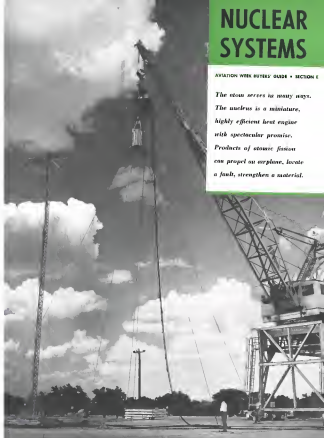


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NUCLEAR SYSTEMS

AVIATION WEEK BUYER'S GUIDE • SECTION 1

*The atom serves in many ways.
The nucleus is a miniature,
highly efficient heat engine
with spectacular promise.
Products of atomic fusion
can propel an airplane, locate
a fault, strengthen a material.*



SECTION E: NUCLEAR SYSTEMS

Atom-Powered Flight by 1960 Is Goal

Only time lies between today's plan and tomorrow's realization of the atom-powered airplane.

Best estimates for a first flight of such an airplane point to 1960.

The race toward the goal of an atomic nuclear engine has been paced by technological developments all along the route. Specific contributions have been made in reactor design, in fuel arrangements, in shielding and in control of the fission process. Most notable achievement is the successful completion and shakedown run of the atomic powerplant in the Navy submarine USS Nautilus, the world's first vehicle to be driven by the heat energy of atomic fission.

Any nuclear engine is basically a heat engine, with the fission process replacing the conventional combustion chamber. The heat made available by fission becomes useful energy by being transformed to some working fluid, medium, mobile, water or air. The hot fluid flows because the direct source of energy to drive a turbine, a turboprop, or a pump jet engine.

Only the description of the cycle is simple. Nuclear fission produces enormous heat, so they heat transfer techniques must be highly refined and developed to take the energy of fission nearly undisturbed to where it can do some useful work.

Nuclear fission also produces extremely dangerous byproducts, radiation at various energy levels which can kill, maim or render a man after a short exposure. Shielding has been devised to protect humans, organisms from the death rays of fission, but the same shielding laws have again from the obvious need to make shielding as light as possible for the atomic powerplant.

A third set of problems arises from the control of the fission process. Started by a slow neutron, fission can become a chain reaction with neutron or explosive results if it is not controlled with precision. The control is a gas control system, a moderator, a control which has the precise mechanical ability of being a neutron trap, it slows the neutrons produced during fission and by holding them captive, prevents them from starting new fission reactions.

Nuclear Engine

The fundamental components of a nuclear engine for an airplane include:

- Heat source, the fission process taking place in the fuel core or other arrangement of fuel within the reactor.
- Heat exchanger, which takes the heat from the reactor core and transfers it to the rest of the engine.
- Power converter, which takes the heat energy out of the fuel and converts it to mechanical energy to drive the airplane.

graph. The first is to determine the detrimental effects on the structural materials used to build reactors, to ensure the fact, and to handle the heat transfer medium. The second is to find—sometimes by accident—how to strengthen or improve materials by subjecting them to atomic radiation. A case in point is a simple plastic bottle made by General Electric's plastics division. This bottle was, like many other plastics, limited in its strength if heat it could take. But after radiation had done its work, the bottle could take more than double its original temperature limit.

The implications of this work are tremendous. Learning how to control radiation and understanding its effects on metals, woods and plastics, can result in a completely new technique of radiation treating to strengthen materials and at the same time, to make them more resistant to atomic radiation. Radiation can permit remodeling of the structural arrangements of the atoms making up the solid masses of metals so that optimum strength or fatigue or creep properties can be built in.

Nuclear Detective

Among the most useful properties of some of the radioactive products of fission is their extremely brief life. The sensitive electronic eye of a Geiger counter, the electronic hand of a detector, can find out the exact time that a substance will or is about to decay.

Every minute traces of such a substance will set the counter ticking the contents. From this probability of radioactivity a new series of inventions and new techniques have been born. One dramatic example of the use of tracer chemicals was in the experiment where investigators used the British Royal Air Force Establishment on the ill-fated de Havilland Comet airplane jet transport. There was some belief that fuel had seeped into the engines and exploded in the wing, had been so polluted by a hot source.

A radioactive tracer was suspended in the fuel and as the engines were run after some time, overnight until after the entire trailing edge of the wing was detected. The clicking pointed to the position of fuel in places where it did not belong, showed that it had been there. Later research proved that the concentration of fuel there was not dangerous.

The world of the atom is a new one that offers endless possibilities in scientific development. It is a power source and at a ratios to improve materials. These, among, and others yet to be discovered, lie ahead.

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SECTION F

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It's good citizenship and good business both for your firm to join efforts to check housing decay... to stop slums before they start. In fact, it's the responsibility of every business, as it is of every other good citizen, to support community improvement efforts.

Some slums are beyond repair. They should be torn down and a fresh start made. Others can be remodeled, made to conform to better living standards. So it is up to you to join behind every sound program which seeks to provide adequate housing for all our people.

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Send for a free copy of "ACTION." It explains what ACTION is and proposes to do. It also lists books, research reports, check-lists, and other material which can help you present the housing needs of your community. Address: P. O. Box 306, Radio City Station, New York 20, N. Y.



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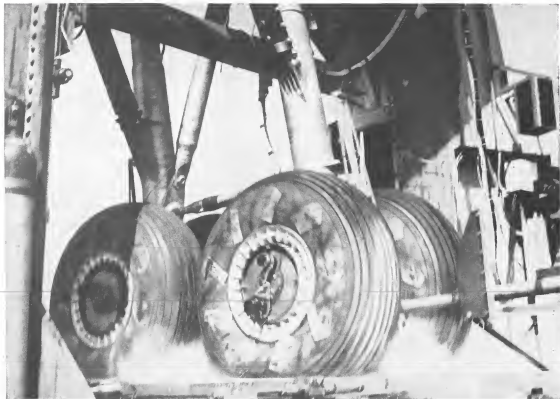
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